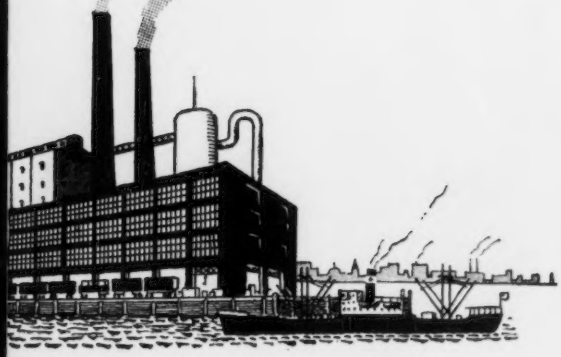
Vol. 32 No. 1
January 1956

ECONOMIC GEOGRAPHY



Clark University ∽ Worcester, Mass., U.S.A.

SUBSCRIPTION INFORMATION

ECONOMIC GEOGRAPHY is a quarterly journal published by Clark University for the benefit of geographers, economists, teachers, professional and business men, and all others who are interested in the intelligent utilization of the world's resources.

Regular subscription rates (except to charter subscribers) are $6.00 per year or $11.50 for two years (plus 50c per year for mailing charges outside the United States and its Territories and Canada) payable in full in United States dollars at Worcester, Mass.

A special rate of $3.50 per year (payable in advance in United States dollars) is available to students enrolled in universities or colleges anywhere. Student subscriptions are renewable at the same rate, but for only one year at a time. For such renewals a note from a department chairman is required, testifying to continued student status.

Single copies of back numbers beginning with Volume 30 will be sent to any American address for $1.75 each; to any foreign address for $2.25. (For all issues preceding Volume 30 the single copy cost is $1.50 domestic and $2.00 foreign.) The price for a complete set will be furnished upon request.

Subscribers are requested to send notices of change of address at least five weeks before they are to take effect. The old as well as the new address must be given.

Indexes of ECONOMIC GEOGRAPHY are issued every October for the volume just completed and are bound into the October issue. A cumulative index for volumes 1 to 25 is available (cloth covered, $5.00; paper covered, $4.00). The articles in the magazine are also indexed in the International Index to Periodicals to be found in every United States Library.

Send all subscriptions and orders to ECONOMIC GEOGRAPHY
Clark University
Worcester 10, Mass., U.S.A.

INFORMATION FOR CONTRIBUTORS

This magazine publishes articles in the field of economic geography as well as articles in adjacent fields that contribute to an understanding of the world's economic patterns.

All articles should be typed on 8½ x 11 inch paper and should be double-spaced. Authors are requested to send with each article a statement as to the field work, special experience, or other background on which the article is based. They are also urged whenever possible to submit maps and graphs in such form that they can be reproduced directly. In cases where it is necessary these will be redrawn at the editorial offices, but this may result in delay in publication. Delay will be avoided, also, if the author will send a caption with each illustration. All map or chart captions should show the source of data or other information unless this is already given in the illustrations. The sources of information for all tables, too, should be shown. Wherever a photograph is used that was not taken by the author, some source credit should appear in the caption.

A reasonable number of footnotes can be used with each article, but authors are requested to keep them to a minimum. Particularly, long informational footnotes should be avoided. All footnotes should be inserted between lines wherever they occur in the text rather than at the bottom of the page or at the end of an article.

Galley proof will ordinarily be submitted. Lengthy or unusual changes in proof will be charged to the author. An order blank for reprints will accompany the galley proof. Fifty reprints without covers will be furnished free to each author.

The originals of all illustrations will be destroyed within one month of publication unless their return has been specifically requested before that time. Authors will be billed for postage on all illustrative material returned.

All manuscripts submitted for publication and all books for review should be addressed to the Editor, ECONOMIC GEOGRAPHY, Clark University, Worcester 10, Mass., U.S.A.

ECONOMIC GEOGRAPHY

CONTENTS FOR JANUARY, 1956

The Problem of Hinterland and Foreland as Illustrated by the Port of Hamburg *Guido G. Weigend* 1

China's Transport Problem, and Communist Planning . . *Rhoads Murphey* 17

The Traffic Pattern on American Inland Waterways . . . . *Donald Patton* 29

A Rural Component of Centrality Applied to Six Southern Counties in the United Kingdom . . . . . *H. E. Bracey* 38

Recent Expansions in the Southern Pulp-Paper Industries . *Merle Prunty, Jr.* 51

Japanese Land Development in Kojima Bay . . . . . *John D. Eyre* 58

Economic Geography and the Manufacturing Industry of Northern Ireland *Morgan D. Thomas* 75

Book Reviews

Brinley Thomas: Migration and Economic Growth, A Study of Great Britain and the Atlantic Economy . . . . . *Thomas R. Smith* 87

Eugene Staley: The Future of Underdeveloped Countries: Political Implications of Economic Development . . . . . *Jean Gottmann* 88

Earl Parker Hanson: Transformation: The Story of Modern Puerto Rico *John P. Augelli* 89

Clarence F. Jones and Rafael Picó, Edits.: Symposium on the Geography of Puerto Rico . . . . . *Earl Parker Hanson* 91

Robert Capot-Rey: Le Sahara Français . . . . . *Benjamin E. Thomas* 92

Axel Sömme: Jordbrukets Geografi i Norge . . . . . *Clara Rom Lougee* 93

The editors and the University assume no responsibility for statements and opinions expressed by contributors

ECONOMIC GEOGRAPHY

Editorial and Business Offices: 950 Main Street, Worcester, Mass.

Published Quarterly at
Commonwealth Press, 44 Portland Street, Worcester, Mass.

PRICE, $1.75 THE CURRENT NUMBER SIX DOLLARS A YEAR
(except for charter subscribers)

Entered as second class matter at the Post Office at Worcester, Mass.
under the Act of August 24, 1912

Copyright 1956 by Clark University, Worcester, Massachusetts

THE FUTURE

Among forthcoming articles are:

The Commerce of the Sault Canals . . . . . *Albert G. Ballert*

Twenty-five Years' Use of the 9-foot Ohio River Channel . *Thomas Frank Barton*

Some Notes on Recent Trends in Rice Production in Cuba . . *Raymond E. Crist*

Some Observations on Land Use in Iraq . . . . . *D. Hywel Davies*

Sugar Regions of Cuba . . . . . *Donald R. Dyer*

The Iron and Steel Industry of China . . . . . *Muzaffer ErSelçuk*

The Pattern of Sex Ratio in New Zealand . . . . . *S. H. Franklin*

The Changing Distribution of Sheep in Britain . . . . . *John Fraser Hart*

Substandard Urban Housing in the United States: A Quantitative Analysis
George W. Hartman and John C. Hook

Yugoslavia in Transition: Industrial Expansion and Resource Bases
George W. Hoffman

The Intensification of Finnish Farming . . . . . *S. Jaatinen and W. R. Mead*

Lunsar: A Study of an Iron Ore Mining Center in Sierra Leone *H. Reginald Jarrett*

Examples of Changing Peasant Agriculture in Croatia, Yugoslavia
W. B. Johnston and I. Crkvenčić

Millionaire Cities, 1955 . . . . . *Audrey M. Lambert*

Use of Indirect Benefit Analysis in Establishing Repayment Responsibility for Irrigation Projects . . . . . *M. E. Marts*

American Orchard and Vineyard Regions . . . . . *Clarence W. Olmstead*

Principles of Areal Functional Organization in Regional Human Geography
Allen K. Philbrick

The Retail Potential of Some Representative New Zealand Towns . *L. L. Pownall*

Land Use at Soba, Zaria Province, Northern Nigeria . . . *R. Mansell Prothero*

The Small Highway Business on U.S. 30 in Nebraska
John M. Roberts, Robert M. Kozelka, Mary L. Kiehl, and Thomas M. Newman

Some Aspects of Industrial Diversification in the United States . . *Allan Rodgers*

Railways and Ports in French West Africa . . . . . *Benjamin E. Thomas*

Livestock Units and Combination Regions in the Middle West
John C. Weaver, Leverett P. Hoag, and Barbara L. Fenton

Cebu: Focus of Philippine Interisland Trade . . . . . *Frederick L. Wernstedt*

Internal Exchange of Staple Foods in the Gold Coast . . . . . *H. P. White*

ECONOMIC GEOGRAPHY

VOL. 32 JANUARY, 1956 NO. 1

THE PROBLEM OF HINTERLAND AND FORELAND AS ILLUSTRATED BY THE PORT OF HAMBURG*

Guido G. Weigend

Dr. Weigend is Associate Professor and Chairman of the Department of Geography at Rutgers University.

AN international seaport might be considered an indicator of certain changes in the economic-geographical climate of both the country wherein the port is situated and the areas with which it has commercial liaison. Hamburg is such a port, located in post-war West Germany where problems of drastic political and economic change have evolved between 1938 and 1953. In this case Hamburg itself is at present in a peculiar dilemma of semi-restored importance which can be seen in perspective by a study of the port's hinterland, its foreland, and the contingent maritime ties.

HINTERLAND AND FORELAND IN PORT GEOGRAPHY

"Hinterland" and "Foreland" as they are used here require some elaboration as to usage in the field of port geography. The word "hinterland" not only has been used freely in German but it has also been adopted into the English, French, and Italian vocabularies. The word as used is frequently ill-defined. Sargent in his major work, *Seaports and Hinterlands*,[1] defines hinterland simply as the area which a port serves, and then attempts to restate his definition by saying that it may be possible to "define approximately an actual area, which we can regard as a coherent whole in relation to an outlet or group of outlets." This area, he says, "may be styled the hinterland." However, since the war, there have been attempts to attach special significance to the "hinterland." Boerman states in the preliminary report of the Commission on Industrial Ports of the International Geographical Union that "It is the hinterland combined with transport links, that gives the key to growth of port trade and development of port industries. No port structure can be understood when not seen together with its 'hinterland.'"[2]

The late F. W. Morgan, in *Ports and Harbours*,[3] states that a simple parcelling out of the country behind ports is an

*This is one of a series of articles resulting from field work undertaken with the sponsorship of Rutgers University and the Office of Naval Research. Reproduction in whole or in part is permitted for any purpose of the United States Government.

[1] A. J. Sargent: *Seaports and Hinterlands*, Adam and Charles Black, London, 1938, p. 16.

[2] W. E. Boerman: "The Need for Special Examination of Particular Aspects of Port Geography," *Tijdschrift voor Economische en Sociale Geografie*, Vol. 42 (December 1951), p. 348.

[3] F. W. Morgan: *Ports and Harbours*, London: Hutchinson's University Library, 1952, p. 111 ff.

inadequate interpretation of the concept "hinterland"; he correctly finds that a port has a great number of hinterlands, the structure and areal extent of which vary. According to Morgan, three main factors account for the variations: (1) the nature of commodities—whether bulk cargo or general cargo are more important, or a combination of the two; (2) the mechanism of sea transport, by which he probably means such factors as types of ships, number of lines, frequency of calls, and nature of port equipment available; and (3) the influence of political policies, such as those concerning the control and use of inland waterways, and the rate structures of inland waterways and railroads.

On the basis of the interplay of these three factors Morgan devises a hierarchy of hinterlands, which are as follows in order of increasing complexity:

1. Primitive hinterlands are those over which individual ports have undisputed control. Such hinterlands have no other sea outlets either because they are islands with only one port or because lateral traffic to any other coastal port is lacking.

2. Raw material hinterlands generally involve bulk cargo and frequently tramp shipping or specially designed ships such as ore boats or tankers. The ports of these hinterlands are located so as to cut land transport of bulk commodities to minimum distances.

3. Liner port hinterlands are the largest in extent and most complicated in structure. They are composites involving a great variety of cargo, both bulk and general, and requiring many different services. In connection with this category Morgan reintroduces the terms "primary" and "secondary" hinterlands. The former had been used by Ullman in his Mobile study[4] and means the area in which the port is well established; in the secondary hinterland, if such clear-cut division really exists, rivalry among ports is a "free-for-all."

The basis of Morgan's classification is much too limited to give it validity. By choosing only the three main factors given, he seems to underestimate the importance of such other vital factors as inland transport or agricultural, industrial, and urban development in the interior or in overseas areas, although he brings these into the discussion prominently in connection with each hinterland. Morgan presumes that he has evolved a hierarchy of hinterlands by their structure and areal extent; yet, judging from the discussion, primitive hinterlands frequently are larger than raw material hinterlands and may be as complex as liner port hinterlands. The latter are undoubtedly the most numerous in the world; in fact so much is included in that category that it loses its significance.

Elsewhere, Morgan attempted to delimit the extent of the hinterland by imposing a limit for hinterland areas which received from and sent to the port in question a total of 50,000 tons of goods in each direction,[5] but such a limitation is admittedly arbitrary; it is only likely to obscure the true traffic picture.

The French school of thought wishes to do away with the term "hinterland" altogether. In a series of articles in *La Porte Océane*, M. Lemierre and others, notably M. Amphoux, develop the idea that the maritime relations of a port are of primary significance, overshadowing all other factors. In the early stages of argumentation the authors classify types of hinterland into regional

[4] Edward L. Ullman: *Mobile: Industrial Seaport and Trade Center*, University of Chicago, 1943.

[5] F. W. Morgan: "Observations on the Study of Hinterlands in Europe," *Tijdschrift voor Economische en Sociale Geografie*, Vol. 42, December, 1951, pp. 366–373.

and supra-regional hinterlands. The regional hinterland consists of the "natural" hinterland and the area of functional development. "Natural," or "physical," is synonymous with "geographic" and "static" by their definition, one with which many geographers would not agree; and the area of functional or "dynamic" development is the area won over from other ports. A port becomes a supra-regional port when the area of functional development extends beyond the "natural" hinterland; for these larger ports the maritime outlook becomes the determining factor —or, expressed differently, a "maritime determinism" is advocated as opposed to a "land determinism."

The next logical step in their argument is the classification of ports into two great categories: (1) those which depend on the organization of continental space, and (2) those which depend on the organization of maritime space. Stated in other words, man has organized maritime space and continental space, and the port is there to join the two and to serve them. Maritime space organization has two subdivisions. (1) Tramp shipping is actually disorganized in oceanic space and the merchandise, generally bulk cargo, seeks the port of handling according to the most favorable factors of operation on the continent. (2) Regular line shipping, on the other hand, has organized patterns in maritime space and subordinates continental organization to its conditions. It is concluded that, inasmuch as liner shipping is constantly gaining at the expense of tramp shipping, the maritime organization dominates continental organization more and more.

The term "foreland" to my knowledge has never been applied in connection with ports. The meaning of the term is not synonymous with "maritime organization." The "foreland" of a port, as here used, indicates those areas which are connected with that port by means of ocean carriers. While maritime space certainly is organized, it has been organized not as an end in itself but in order to serve as a connecting link between land areas. Thus a new concept is introduced for consideration, which in turn sheds new light onto the organization and function of maritime space.

The primary function of maritime space in terms of this analysis is to provide an avenue of traffic between continental spaces. As such it is subservient to both hinterland and foreland, and its organization can adjust itself much more easily to political, economic, and social changes than the organization of continental space. With the exception of air transportation, ocean transport is the most flexible of all means of transport and also the most easily adjustable.

HAMBURG'S HINTERLAND

To illustrate let us take Hamburg. Before World War II, Hamburg was a world port through which passed 23 per cent of the total traffic of the large continental North Sea ports. In 1938 the port handled some 25 million metric tons of maritime cargo. If 3 million tons of coastal traffic are excluded, about 40 per cent of the tonnage handled had its origin and destination in areas which are now behind the Iron Curtain (Fig. 1); nearly 50 per cent of the sea-going traffic was between Hamburg and areas now included in the West German Federal Republic outside the Iron Curtain.

Comparing the hinterland traffic volume of 1938 with that of 1953 it is apparent that quantitatively all traffic important to port life decreased except that to and from Hamburg itself. The most significant absolute decline can be observed first in German areas which are now behind the Iron Curtain, the

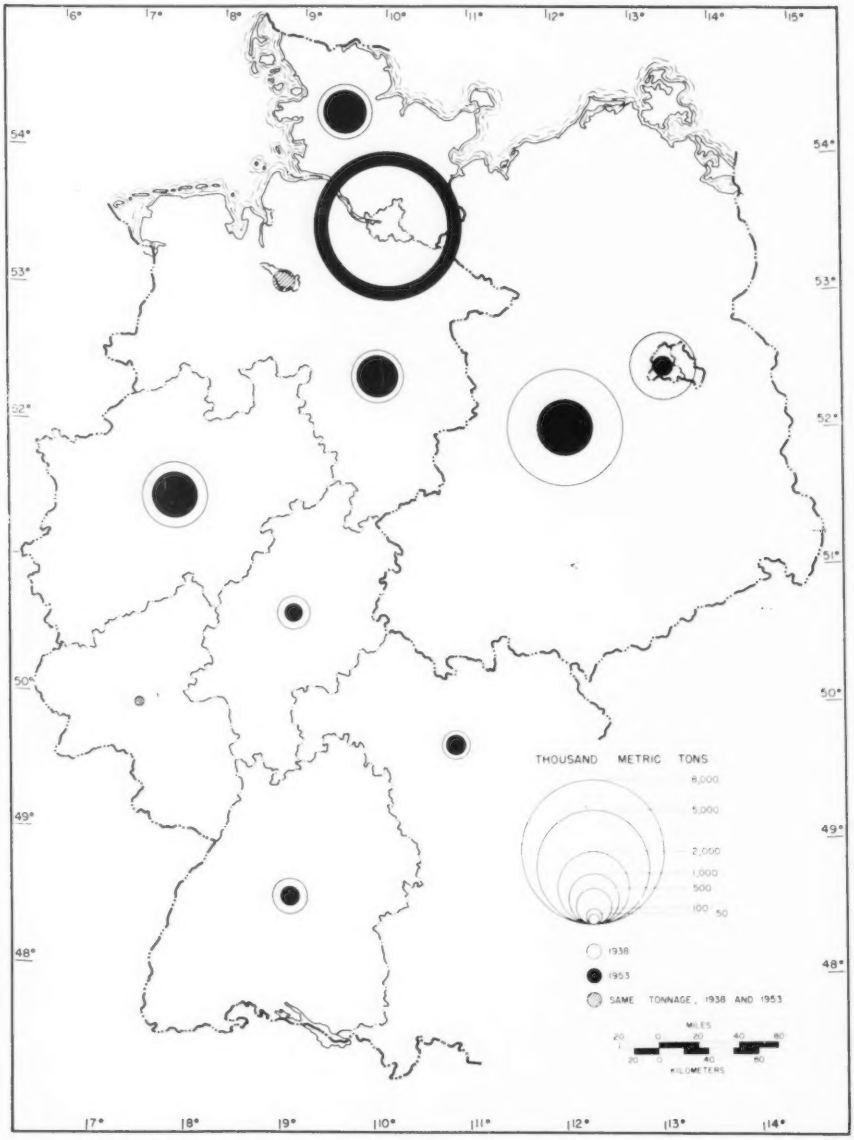


FIG. 1. Hamburg hinterland traffic in East and West Germany, 1938 and 1953.

East German Democratic Republic including East Berlin, and West Berlin; secondly, among foreign countries (Fig. 2), Czechoslovakia, Switzerland, and Hungary; Poland and Rumania were completely eliminated in 1953. The total volume of traffic had recovered very slowly after World War II, and by 1953 the seagoing traffic amounted to only about 65 per cent of what it had

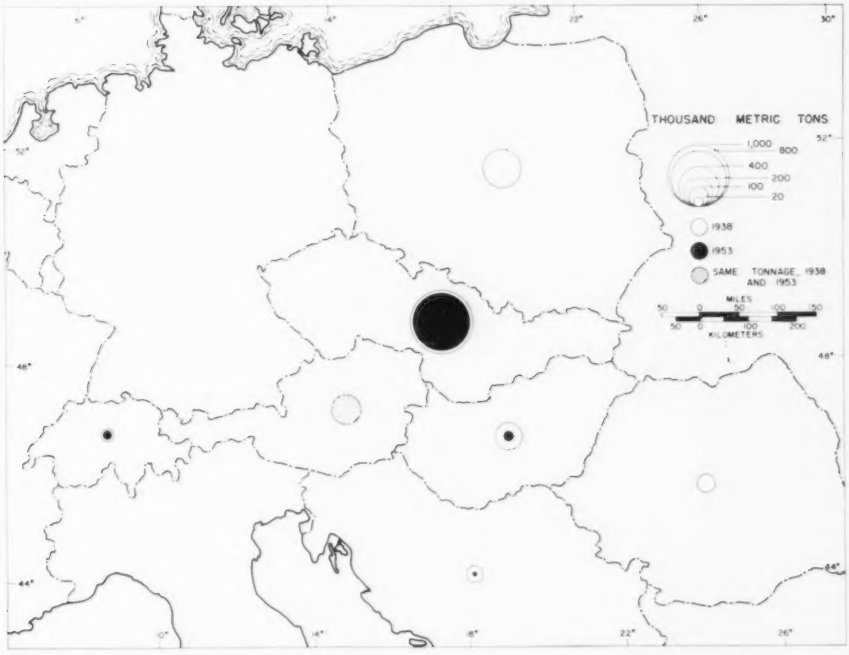


FIG. 2. Hamburg hinterland traffic in Europe outside Germany, 1938 and 1953.

been in 1938. Simultaneously, and despite the general tonnage decrease, West Germany's participation in Hamburg's maritime traffic, excluding West Berlin, increased from 48 per cent in 1938, to 80 per cent in 1953.[6] However, Hamburg had absorbed only 44 per cent of that West German traffic in 1938, whereas in 1953 the absorption amounted to 74 per cent. The port and city thereby had become more of a terminus for merchandise passing through the port than it had ever been before. Among foreign countries both Czechoslovakia and Austria had reappeared in Hamburg's traffic picture strongly. In fact the relative standing of both countries was more favorable in 1953 than in 1938, and Austria's actual tonnage was nearly equal to the 1938 tonnage. The transshipment activity of the port, which before the war amounted to about one-tenth of the total traffic, was barely 3 per cent of the traffic in 1953.

What are the implications of this comparative analysis with regard to the port-hinterland relationship? Hamburg has maintained consistently that the slowness of recovery of its port traffic has been caused largely by the loss of nearly half its hinterland at a time when eastern and western Europe were separated politically and economically by Soviet policy. This theory is only partially valid, because traffic volume decreased nearly everywhere, as already pointed out, regardless of the Iron Curtain. Factors are manifold and vary from place to place. Although traffic between Hamburg and the East Zone was negligible until 1951, an up-

[6] These and other figures were calculated from publications and unpublished materials of the Handelsstatistisches Amt der Freien und Hansestadt Hamburg.

swing began in 1952 which was continuing in 1953.

Soviet policy in East Germany after the war, followed later by that in the East German Republic, was to channel traffic to and from the Russian zone by way of East German Baltic ports, even though shipping costs through Hamburg might have been lower. Port facilities have been restored and expanded in Baltic ports and their operation, as that of inland carriers, placed under government control.

At the end of the war, the Allied forces, for their part, abolished most of the German pre-war preferential railroad freight rates. Thus the ports at the mouth of the Rhine River, being located closer to the great West German industrial complexes and connected with them by the Rhine River, gained an absolute advantage with respect to sea-borne traffic over German ports and recovered rapidly. Moreover, the Allies required that all rates for cargo passing through Germany in transit be paid in dollars. With the existing general dollar shortage the effect was that transit traffic through West Germany remained at a minimum. By 1950 both policies had been changed and preferential railroad rates for maritime cargo were re-established gradually. In the meantime, however, the Dutch and Belgian ports had had five years in which to develop their contacts anew without serious interference from their German competitors.

Allied policy brought other repercussions. Among port industries shipbuilding and ship repair was—and is again—the chief industry in Hamburg in terms of number of people employed. Hamburg's shipyards suffered severe damage from air raids, and furthermore the Allies until 1950 curbed drastically the building activity in German yards, thereby affecting port traffic and employment. Finally, the prohibition of shipment of strategic goods to the Communist block after the outbreak of the Korean war reduced traffic somewhat, but this reduction was more than compensated for by generally increased industrial and shipping activity resulting from the war.

Yet another factor in the slow recovery of port traffic is Hamburg's location in the new West German Republic. When East and West Germany were divided politically, the new boundary was drawn southward from the Baltic Sea only some 25 miles east of Hamburg. While before this event Hamburg was situated centrally and favorably with respect to its southeastern hinterlands, it now found itself, offset by an international boundary, in the northeastern corner of the new Republic. Consequently the port, contending for new traffic to and from areas in central and southern West Germany, met with serious competition from Bremen, which distance-wise is in a much more favorable position. In addition, Bremen became the port used by American military forces for both materiél and economic aid. Both these circumstances stimulated the rapid reconstruction and recovery of the Bremen-Bremerhaven port complex, so that in 1953 the tonnage handled there, as with the ports on the lower Rhine, had exceeded by far the pre-war tonnage. To gain equal footing with Bremen at least with regard to distance, Hamburg has been advocating the principle of "port equalization," that is, the establishment of a railroad rate structure which would give equal rates to all German ports from any one point within West Germany, regardless of distance from each port. Although a readjustment in the rate structure was agreed upon between Hamburg and Bremen, complete equali-

FIG. 3. Bridges across the north branch of the Elbe River. Principal highway bridge on the right, railroad and second highway bridge on the left. The latter serves only traffic within the free port which begins at the bridge and extends toward the left, downstream. (Plan und Karte, G.m.b.H. Released by Ministry for Economy and Transport Nordrhein-Westfalen, No. P.K.100, Nov. 16, 1954.)

zation remains a goal for Hamburg authorities.[7]

[7] The author obtained this and succeeding information from documents and interviews in the city of Hamburg while doing field research in the summer of 1954.

HINTERLAND TRANSPORTATION PROBLEMS

In connection with the ease of traffic flow toward the interior, the problem of feeder lines out of Hamburg toward the

interior remains to be discussed. The problem existed even before World War II, but has been sharpened since the war. It consists of two aspects—one in relation to the site, the other to the situation of port and city.

At Hamburg the Elbe River is divided into two arms, at that point about six miles separated from each other. The main city of Hamburg is located on the right bank of the northern branch; the outlying Harburg, since 1937 a part of the city state of Hamburg, on the left bank of the southern branch; and the principal port basins extend along the northern margin of the island between the two branches. The first aspect of the problem suggests itself at once—the crossing of the two branches of the Elbe River; because the north-south traffic is heavier than in any other direction, the problem assumes considerable proportions. The northern branch of the Elbe River is spanned by only two main bridges—one railroad and one highway bridge; a third bridge serves road traffic within the free port only (Fig. 3). The southern branch is crossed by one railroad bridge and by two highway bridges. All these crossing points are bottlenecks for local commuting traffic as well as for long-distance haulage. The existence of a narrow tunnel under the north branch, constructed early this century, does not alleviate the problem, because the tubes are narrow and vehicles must be transported by elevators from street to tube level.

The second aspect of the inland transport problem concerns the integration of Hamburg with the network of West German transportation lines. This is particularly crucial in view of the fact that Hamburg has sought to strengthen its traffic ties with the rest of West Germany to compensate for losses elsewhere. An efficient and rapid link with potential and actual interior markets means a better competitive position despite longer distances to areas where many major European continental ports are competing with one another.

From the standpoint of integration alone, the railroads present no obstacle. Hamburg is well served by a network of double-track and single-track railroad lines and the only improvement suggested repeatedly in recent years is electrification of the principal lines to speed up service.

The main problems connected with inland transport derive from highways and inland waterways. Both can compete against greater distances to and from Hamburg. High value truck cargoes can absorb the higher rates whereas inland shipping is a cheap means of transportation for bulk cargo, regardless of relatively minor differences in distance.

The construction of superhighways (*Autobahnen*) in the North of Germany before the war was limited to only one, leading from Lübeck to Bremen by way of Hamburg (Fig. 4). South of Hamburg a branch was planned to provide a north-south link with other superhighways in central and southern Germany, but the outbreak of the war prevented realization of these plans. Although the highway network focussing on Hamburg may appear dense on an ordinary highway map, these highways, except for the *Autobahn*, have many curves, are narrow, and are in poor condition. They cannot meet the demands of modern trucks and trailers which are steadily increasing in number and size, as well as the ever-growing passenger car traffic. A much-needed extension of the superhighway network seems the only solution to the problem. A connection with Hanover would link Hamburg with the east-west artery leading from Berlin to the Ruhr industrial area, and the further extension from Hanover

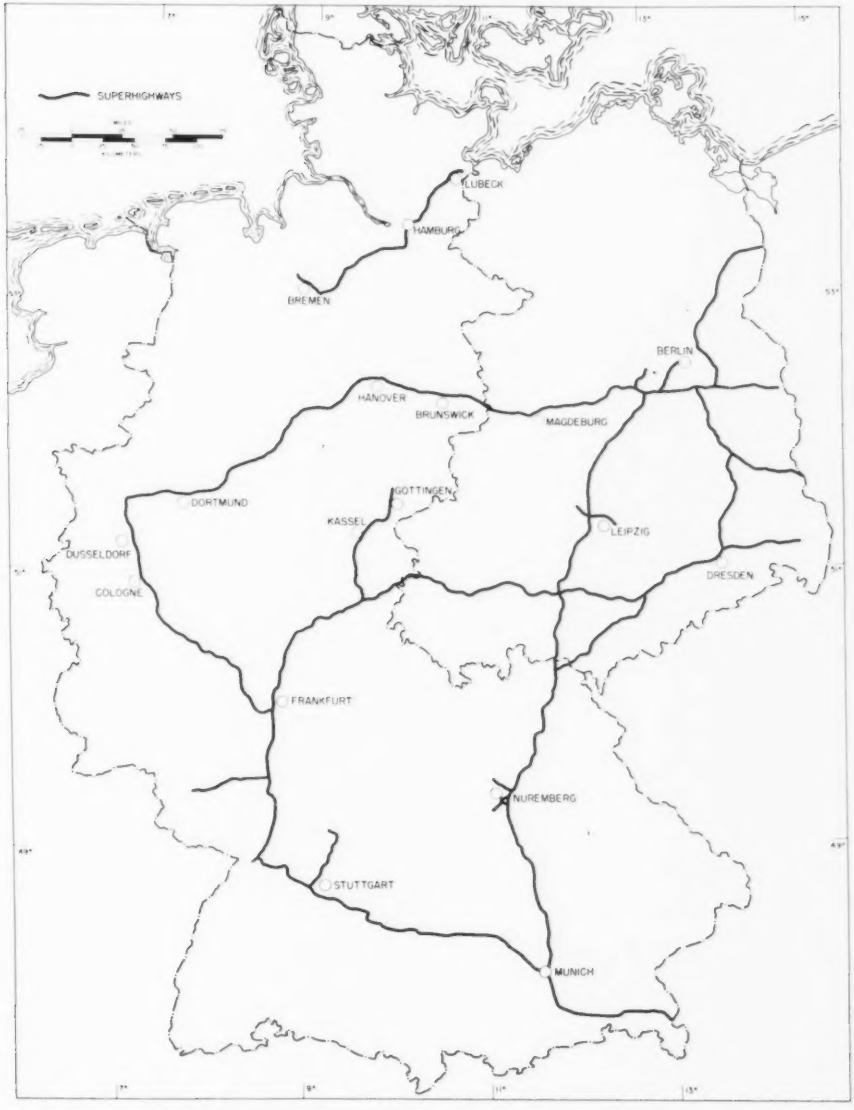


FIG. 4. Superhighways of Germany.

to Göttingen would provide a direct superhighway route to southern Germany.

In Hamburg itself a by-pass around the city would aid in relieving traffic congestion. A new Elbe River bridge for the *Autobahn* southeast of Hamburg would not only make possible through traffic to avoid the already overcrowded existing Elbe River bridges,

but a new exit and entrance could be provided for traffic having its origin and destination in the city.

For inland shipping the Elbe River provides the sole means of penetration into the interior. Although the river system is navigable to Prague, the size of barges is much more limited than that on the Rhine and West German canals, and the flow of the river is seasonal, causing frequent stoppage in the flow of traffic. Nevertheless, the Elbe provides a link with areas behind the Iron Curtain with which traffic since the war has been considerably curtailed as compared with pre-war years. No direct connection with the inland waterway network of western Germany exists, however, a gap in the transportation network which has been a handicap and also a factor in the slow recovery of port traffic.

In order to eliminate this problem, Hamburg has long been advocating the construction of the *Nord-Süd-Kanal*.[8] This canal would connect the port with the Mittelland Canal, the main east-west inland navigational artery of Germany, at a point near Hanover due south of Hamburg. Such construction would become a more dependable waterway than the Elbe River, even if the lower course of the latter were to be regulated. It could thus be used by Elbe River shipping to the Mittelland Canal and thence back to the Elbe at Magdeburg. What would be of even greater benefit to Hamburg, however, would be the considerable shortening of waterway distance to the Hanover–Brunswick–Salzgitter industrial area and to the great Rhine Westphalian complex. Lastly, such a canal would make possible the use of 1000 ton barges, which are normal on other German main canals but are too large for operation on the Elbe River.

[8] There are many references to this problem, among them Hans Bielfeldt, "Hamburger Standortfragen," *Mitteilungen der Handelskammer Hamburg*, October 15, 1952, p. 657.

PORT TRAFFIC

In view of these difficulties and the changes in Hamburg's hinterland cited earlier, it is surprising that the port has recovered even as much as indicated. Because of local initiative, reconstruction of port facilities has always been ahead of traffic needs, or at least at concurrent levels. As already noted, a considerable amount of the recovery must be credited to the rapid reestablishment of Hamburg as the second city of Germany population-wise and as an industrial center. The increasing role of the city as a terminus for imports and to a lesser extent as a point of origin for exports in normal times would be an unhealthy trend for the port, considering particularly the greatly increased industrial activity in West Germany as a whole. However, Hamburg is happy to have the local hinterland, concentrated as it may be, because it keeps the port alive until long-range solutions for an inland expansion can be worked out.

As can be expected, there have been pronounced shifts in the destination, origin, and even the nature of goods which pass through the port. The most outstanding of these is the combined import of petroleum and petroleum products (Table I). In 1938 and 1953 Hamburg imported a total of 3.4 and 2.9 million tons respectively, but of the 1938 figure, 2.8 million tons, or 82 per cent, was petroleum products; in 1953, 2.3 million tons, or nearly 80 per cent, was crude oil. This profound change is in part a reflection of the vast expansion of refining in Germany which has resulted in a shift of the international oil tanker movement and the traffic pattern of the port. Though in 1938 crude oil was imported from Venezuela, Mexico, the United States, and the

Dutch West Indies, in 1953 nearly 80 per cent came from the Middle East and the remainder from Venezuela. The large tonnage of refined products used to come from overseas areas, chiefly the Dutch West Indies and the United States. In 1953 European refineries provided the bulk of refined petroleum products, with some importation from the Dutch West Indies and Venezuela. It is noteworthy that crude oil and coal together in 1953 represented somewhat less than one-half of Hamburg's total imports; furthermore, that these raw materials were destined chiefly for refineries and power plants in Hamburg itself, with only minor shipments into adjacent Schleswig-Holstein. Coal imports have not yet reached their imposing pre-war tonnages, and the lead among coal suppliers since the war has been taken from Great Britain by the United States. American coal, even though originating in the "dollar area," is preferred because it is not only cheaper than British coal but also of a better and more consistent quality.

TABLE 1

PRINCIPAL SEA IMPORTS OF HAMBURG

(More than 100,000 metric tons)

	1938	1953
Coal	3,008,268	2,542,728
Crude Petroleum	627,853	2,271,847
Petroleum Products	2,789,259	634,747
Wheat	422,474	311,419
Iron Ore	5,364	266,791
Oranges	60,552	238,325
Occupation Goods	.....	237,541
Logs and Lumber	529,764	233,761
Soy Beans	469,530	229,301
Barley	177,045	180,336
Cinders of Pyrite	74,476	171,407
Crude Rubber	132,703	144,468
Oil Cake	499,726	141,545
Copper Ore	180,670	118,573
Pyrite	245,344	110,178
Corn	842,101	102,422
Copra	239,702	98,154
Skins and Furs	167,410	89,988
Cocoa Beans	139,974	87,224
Coffee (Green)	199,443	85,921
Copper	350,524	85,519
Pulp and Paper	134,514	80,616
Bananas	100,452	74,206
Peanuts	153,023	74,091
Other	6,497,280	2,545,350
Total	18,047,451	11,156,448

Source: Handelsstatistisches Amt, *Handel und Schiffahrt des Hafens Hamburg*, 1938 and 1953.

A spectacular increase in the port traffic picture is the importation of iron ore, which amounted to only a few thousand tons in 1938 but to nearly 268,000 tons in 1953. Most of the ore now comes from India, some from China; all of it passes in transit to Czechoslovakia. Whereas before the war the main source of ore for Czechoslovakia was Sweden with Stettin the principal transit port, Czech trade ties with Asiatic countries have been strengthened since the war, putting Hamburg in the most favorable position for the forwarding of this bulk cargo.

Another striking increase among import figures is that of oranges. A trade agreement with Spain in 1952 permitted unrestricted import of the fruit from Spain. Inasmuch as Hamburg's fruit importers had excellent connections in Spain as well as an efficient marketing and distribution system throughout West Germany, it was Hamburg which enjoyed the benefit of the increased flow of oranges into Germany. With more oranges on the market, consumption has increased, which in turn has stimulated the import business, making it one of the most prosperous activities for the port as well as the merchants.

Among other imports, the majority of categories of merchandise of normal peace-time traffic show decreases from the pre-war tonnages. Although most of them have been climbing steadily from year to year, they have not, for reasons already discussed in connection with the hinterland, reached their pre-war levels. However, there are changes which are not quantitative and therefore do not show in the table—shifts among countries of origin, the forelands of

Hamburg. For example, wheat and peanuts are no longer imported from India because no surplus for export is available there. Wheat imports from the United States and Canada have become more important and China has become a main source of peanuts.

Among the principal exports by weight (Table II), there have also been some striking changes in the years under comparison. Coke and scrap iron exports, both originating in Westphalia, were negligible before the war, but in 1953 they represented about 11 per cent of the export figure. The main foreign markets for scrap metal are Italy and Great Britain; coke moves to Scandinavian countries to replace diminishing imports of that product from Great Britain.

TABLE II

PRINCIPAL SEA EXPORTS OF HAMBURG

(More than 100,000 metric tons)

	1938	1953
Potash Fertilizer	126,464	829,281
Cement	132,702	644,986
Petroleum Products	574,969	476,818
Coke	22,572	338,589
Iron Goods	413,258	329,883
Scrap Iron	36,929	239,827
Ammonia	121,064	207,165
Machines	150,797	185,071
Oil Cake (incl. Soya Cake)	443,211	155,767
Chemicals	624,092	131,384
Paper and Pulp	302,892	129,610
Refined Sugar	177,140	116,857
Salt	145,529	77,425
Glass and Glasswares	106,334	74,516
Corn	336,051	27,262
Wheat	413,077	9,192
Other	3,111,115	1,348,695
Total	7,238,196	5,322,328

Source: Handelsstatistisches Amt, *Handel und Schiffahrt des Hafens Hamburg*, 1938 and 1953.

Potash fertilizer and cement occupy first and second place in the table. Although their relative increases have not been so spectacular as those of scrap iron and coke, their combined figure represented nearly 30 per cent of Hamburg's total exports in 1953, as opposed to about 4 per cent in 1938. Simultaneous with this increase has been an expansion of the market areas of potash fertilizers. Though before the war potash fertilizer was shipped chiefly to countries in northern Europe, Japan has been added to an imposing list of customers; in fact Japan imported the largest tonnage of any one country. The increase in the export of potash as well as ammonia and other fertilizers, results from the desire on the part of East Germany to intensify its efforts to sell these products in countries outside the Iron Curtain. Cement, also originating in East Germany in part, already had a world-wide distribution before the war. In the long list of buyers Brazil led in both years. This lead was much greater, however, in 1953, in which year Brazil purchased one-third of all cement exported through Hamburg. New market areas, moreover, were opened up, such as Saudi Arabia, the second best customer, and Canada, which holds third place.

Most of the other items in Table II were smaller in 1953 than in 1938, for reasons discussed earlier. For instance, sizeable oil cake shipments to East Prussia and Pommerania as well as salt shipments to the Baltic republics made in 1938 have not been resumed. In general, exports are manufactured and semi-manufactured products, a multitude of items which have distribution in many different parts of the world.

To complete this analysis of traffic patterns it should also be pointed out that certain likenesses exist in the two years chosen for comparison. Before as well as after the war the port had an exceptionally poor balance of traffic. The import tonnage amounted to 71 per cent of the total sea traffic in 1938 and to 68 per cent in 1953. This improvement in the balance is an apparent one only, resulting from the fact that after the war import traffic experienced a

much slower recovery than export traffic. This was a direct outcome of West Germany's endeavor to increase the export of manufactured products rapidly in order to earn foreign exchange. Although these exports leave Germany by means of all types of carriers, Hamburg was bound to profit by the realization of this trend. The imbalance is, of course, a handicap, because it reduces the load factor for ships calling at Hamburg.

Another similarity in pre-war and post-war years, though less pronounced, is the emphasis on bulk goods among the imports of Hamburg. About 36 per cent in 1938 and nearly 50 per cent in 1953 consisted of coal, petroleum, and petroleum products; if other bulk cargo, such as grains, ore, and pyrite are added, these percentages are over 40 and 60 respectively. Hamburg's position in this regard had worsened considerably in 1953. The move toward more and more bulk cargo is considered very unfavorable, because from the financial standpoint general cargo offers much greater earning possibilities to more people in port and city than bulk cargo. This explains the fact that the port in 1953 employed about one-third fewer dock workers than in 1938.

Since the war, forelands outside of Europe have been emphasized in the traffic picture of Hamburg. If our thesis is valid that hinterlands and forelands take precedence over the maritime organization, specific changes in the pattern of sea traffic should also be observable.

MARITIME RELATIONS

Considering now the maritime connections of the port one can detect significant changes in their organization (Fig. 5). Although the number of shipping lines whose ships call at Hamburg has increased over the pre-war period, the total number of scheduled departures was less, about 64 per cent of the 1938 total. A breakdown of the figure will reveal, however, that the number of departures to other continents, save Australia and South America, in 1953 was greater than that in 1938. The overall decline must be ascribed solely to the fewer departures toward European destinations, and especially toward West and East German ports. Thus, in the maritime organization there has been a shift away from Europe and a strengthening of ties with forelands on other continents. The lag in the recovery of European shipping can be attributed above all to the reorientation of East Germany toward the Soviet Union and other satellite states. This is more important even with respect to shipping services than in hinterland traffic, because it is the hope of Communist countries to carry as much cargo as possible in their own bottoms, directly to and from their own ports. For example, though in 1938 five hundred eighty-five ships departed from Hamburg for Stettin, the number in 1953 was only 47. There has also been the trend on the part of a number of European states, notably Scandinavian countries, to further develop and strengthen their own shipping in order to diminish the necessity of transshipment in other ports, including Hamburg.

HAMBURG'S FORELAND

Turning next to the forelands, it is clear that developments there can be equally as important factors in port traffic as those in the hinterlands. The rapid rise of oil production in the Middle East attracted not only oil companies but shippers alike, and a basic readjustment in traffic patterns took place, together with industrial development and national policy in Germany and other European countries. The shift

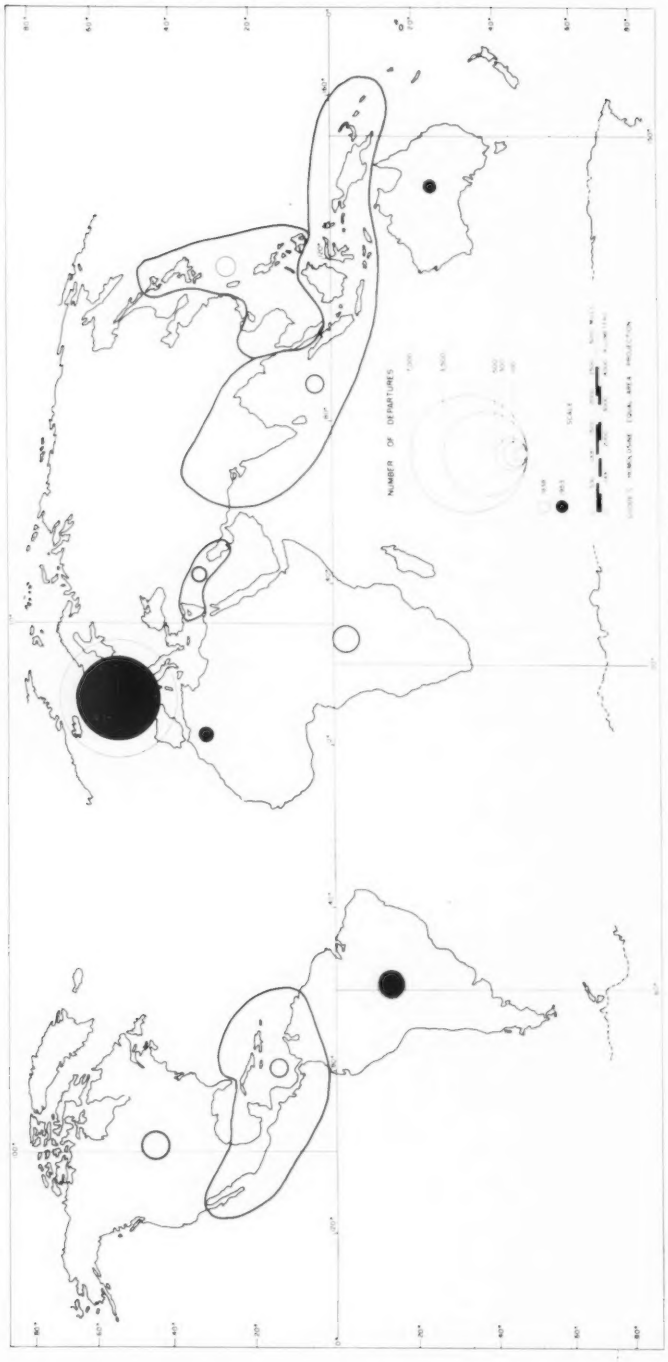


FIG. 5. Maritime Traffic and Forelands of Hamburg.

was aided by the fact that the United States since the war has herself become an importer of petroleum products, and that Mexico's production of crude oil was temporarily curtailed because of expropriation policies there.

The strengthening of Hamburg's shipping ties with the Middle East has come close to pushing those with the United States into second place, not in frequency of sailings but by cargo tonnage carried to and from Hamburg. The present principal tie with the United States did not exist before the war—that of coal. As already stated, high quality American coal can be obtained cheaper in Hamburg than coal from Great Britain or from the Ruhr, despite greater distances involved, because the United States has better mining methods and a much greater output per man. At the same time Scandinavia proved to be a good outlet for German coke when British deliveries diminished.

Many other items of traffic movement through Hamburg can be singled out as reflecting conditions and needs in the forelands. Intensification of agricultural techniques in various parts of the world, such as Scandinavia, Great Britain, and Japan, stimulated the export of fertilizer products in spite of the fact that much of it originates behind the Iron Curtain; technical development and building promoted shipment of such products as electro-technical articles, machines, and vehicles to countries in Asia, Africa, and Latin America.

If we examine from a general view the import and export tonnages by forelands (Table III), the changes between 1938 and 1953 find expression in the shifted emphasis on various continents. In the total traffic picture Asia has gained most remarkably in both imports and exports, whereas German coastal traffic, based on pre-war boundaries, has lost heavily. With the exception of the German coast, the export figures percentage-wise were more favorable in 1953 than in 1938 to all forelands. In fact, even the actual tonnages of exports had surpassed the pre-war totals to all forelands outside Europe, and the "Other Europe" figure had come close to full recovery. It is in the import column that the lag is apparent in all areas except Asia.

Though it is impossible within the limits of an article to make an exhaustive analysis of the many forelands of Hamburg or of any port, enough evidence has been presented to demonstrate the utility and indeed the necessity of understanding a port's foreland problems to some extent. Thus the foreland becomes an integral part of the entire complex which deals with an analysis of port traffic.

CONCLUSION

A multitude of factors enter into an analysis of the port of Hamburg with respect to changes in its functional and relational patterns. In the study of Hamburg, as that of other ports and ocean transport, it is not sufficient to emphasize only the hinterland, the organization of continental space inland from the port, or only the organization of maritime space on the seaward side of the port; or even both of these concepts together. A further step must be taken by the inclusion of the analysis of the foreland, the land areas which are facing the port beyond oceanic space. Neither hinterland nor foreland can be delimited with precision. The hinterland is not merely an area which ports serve, nor can it be considered the key to port development. The hinterland represents organized and developed land space which is connected with one or several ports, which in turn are points of contact between land and maritime space and provide services for both hinterland and maritime organization.

TABLE III

FORELAND TRAFFIC OF HAMBURG

(Metric tons)

Forelands	IMPORT				EXPORT				TOTAL			
	1938		*1953*		*1938*		*1953*		*1938*		*1953*	
	1000 T.	%	1000 T.	%	1000 T.	%	1000 T.	%	1000 T.	%	1000 T.	%
German Coast	1,585	9	769*	7	2,501	35	474*	9	4,086	16	1,243*	8
Other Europe	6,020	33	3,419	30	2,815	39	2,548	48	8,835	35	5,967	36
Americas	6,661	37	3,321	30	979	13	1,006	19	7,640	30	4,327	26
Africa	1,175	7	647	6	333	5	375	7	1,508	6	1,022	6
Asia	2,420	13	2,944	26	558	7	865	16	2,978	12	3,809	23
Australia and Polynesia	107	1	56	1	52	1	54	1	159	1	110	1
Other	79	...	.....	...	.....	...	.....	...	79	...	.....	...
Total	18,047	100	11,156	100	7,238	100	5,322	100	25,285	100	16,478	100

Source: Handelsstatistisches Amt, *Handel und Schiffahrt des Hafens Hamburg*, 1938 and 1953.
*Calculated on the basis of pre-war German boundaries.

Inevitably, each port attempts to attract as much traffic as possible from *any* direction, inasmuch as more traffic means more life and prosperity and greater prestige. Contingent upon competition among ports a multitude of factors influencing traffic flow may come into play, and generalizations become increasingly more difficult to make.

It is evident that the foreland of a port must also be organized and that, in order to be a foreland, an area must have its own port or ports, which will join it in turn with the maritime organization. The foreland of one port thus becomes the hinterland of another or a group of others, if traffic flow is considered from the opposite shore.

CHINA'S TRANSPORT PROBLEM, AND COMMUNIST PLANNING

Rhoads Murphey

Dr. Murphey, whose "Shanghai: Key to Modern China" was published by Harvard University Press in 1953, is Assistant Professor of Geography at the University of Washington. He is at present in southeastern Asia on a project for the Ford Foundation and the American Friends Service Committee.

IT has been a commonplace to prescribe extension of low-cost volume transport facilities as a solution to China's economic dilemma. Perhaps more than any other factor, inadequate transportation was responsible for the slow pace and small accomplishments of China's industrialization and of the Westernization of the economy until 1949, though governmental weaknesses must share a good deal of the blame. Clearly, effective change in any sector of the country's economic life still must depend on the existence of a transport network which enables a large volume of goods to move cheaply within a unitary national market.

Until 1949, a railway net totalling some 6000 miles (exclusive of Manchuria, which will not be treated here) was largely confined to the eastern lowland. Eight of the 18 provinces had no railways at all, and four others had less than 200 miles each (Fig. 1). The great majority of this mileage had been built by foreign capital and technicians, and the products of foreign-owned mining and industrial enterprises accounted for a large proportion of the goods carried. Motor roads suitable for lightly loaded truck traffic did not exceed 100,000 miles, again concentrated in the eastern lowland. The costs of truck transport remain very high, as a reflection of fuel and equipment problems.

Water transport, the only other volume mover at present, has long been highly developed in China and still carries most of the goods which move over any considerable distances, but it is handicapped by inefficient operation, especially for bulk or volume movements, and by the fact that waterways reach only part of the productive areas of the country.

Despite the beginnings of industrialization and the Communist program of railway building, China is still characterized by a high degree of regional self-sufficiency. In many areas, transport by the only available means doubles the cost of the goods within fifty or a hundred miles. Even with the advantage of the Yangtze system, Szechuan wheat often sold in the 1930's in Shanghai for over three times its price in Szechuan. Coal at the pithead in Shansi cost $5 (Chinese National Currency) per ton in the 1930's, while at Shanghai 500 miles away it sold for $12 a ton.[1] At the pioneer Chinese iron and steel works of Hanyehp'ing at Hanyang on the Yangtze, coking coal was brought 300 miles by water and rail from P'inghsiang; delivered, it ac-

[1] Rhoads Murphey: *Shanghai: Key to Modern China*, Cambridge, Mass., 1953, p. 118.

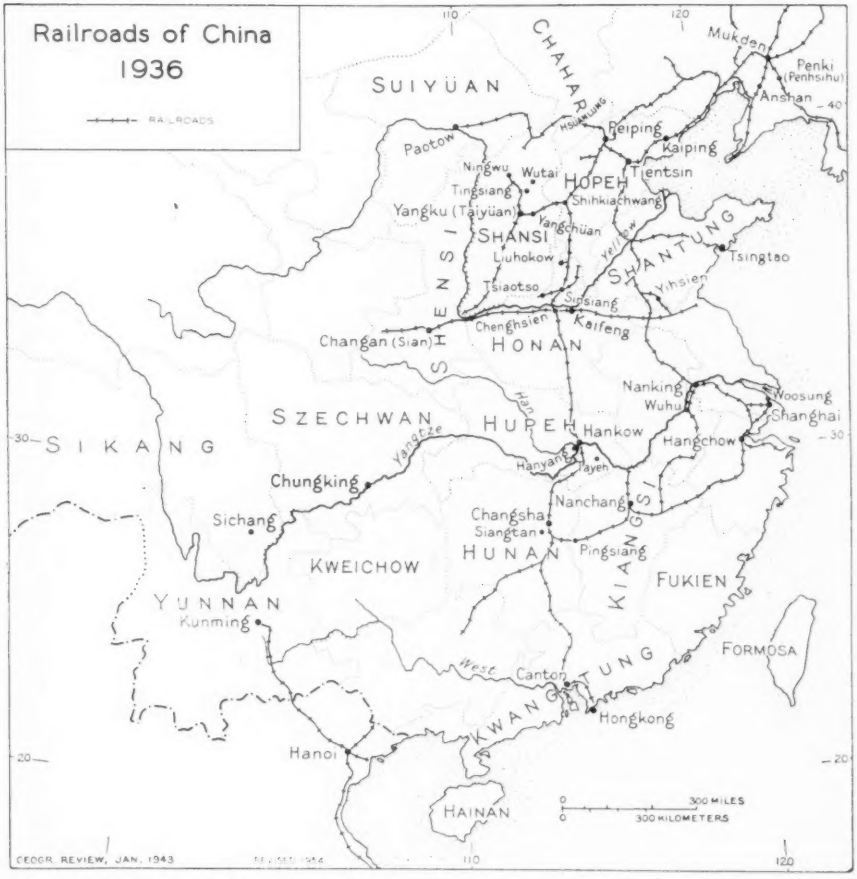


FIG. 1. Railways of China in 1936. Original map by courtesy of the *Geographical Review*, revised 1954.

counted for over half of the total costs of both iron and steel production. The plant stopped operations in 1928, as an obviously uneconomic unit hamstrung by excessive transport charges.[2]

These conditions pose formidable obstacles to industrial development. In agriculture, the transport problem is also acute since it hampers the rise of a national market and the development of regional specialization, with accompanying rises in production, living standards, and demand levels. That the present government of China is aware of this is fully evidenced by its ambitious planning and accomplishments, especially in railway building but also in highway and waterway development.[3] It may, however, be questioned whether, even in a totalitarian economy, the rate of general

[2] For details and cost figures, see D. K. Liu: *China's Iron and Steel Industry*, 1935.

[3] For a more detailed analysis of the current Five Year Plan and other development programs, including highway, railway, and waterway projects, see G. B. Cressey: "Changing the Map of China," *Econ. Geog.*, Vol. 31, 1955, pp. 1-16.

economic growth should be anticipated by heavy capital investment in volume transport facilities to the extent which the government's plans imply. The experience of the past in this respect, and the current nature and extent of transport facilities, provide some guide.[4]

Water Transport

Unquestionably the greatest volume of goods still moves by water, which remains the cheapest carrier. Waterways are relatively sparse in the north, but in the south natural and artificial routes serve most of the productive area, especially of the eastern lowland; the two major systems of the Yangtze and the Hsi (West) Rivers provide a link, with their several tributaries, from the coast to areas as distant as Kweichow, Szechuan, and Shensi. The city of Shanghai is an outstanding illustration of the role of these waterways in supporting even large industrial cities with food, raw materials, and markets. Virtually all of the formerly large agricultural exports of Szechuan (eggs, bristles, hides, t'ung oil, sausage casings, tea, cotton, wheat) moved to coastal and foreign markets via the Yangtze. Largely by virtue of this transport route, Szechuan, although it lies over a thousand miles from the sea, supplied more agricultural goods for overseas export than any other Chinese province.

China is fortunate in that her largest rivers run in the right direction, across the greatest extent of the country from west to east and into the open sea. The Yangtze and its several major tributaries (conveniently flowing alternately from the south and from the north) are a tremendous actual and potential asset, including about half of the country and of its population in a single network of cheap water transport, focused on Shanghai. With the complement of the north-south coastal sea route, China is thus in a very different position from the other two great continental states, Russia and the United States, where water routes run the wrong way or do not serve as large a part of the ecumene, leaving the major transport burden to be carried by railways or roads.

China does not need to be proportionately so dependent on the heavy capital investment which railways require. The Chinese have for centuries paid particular attention to the development of their waterways; in the special and well-known case of the Grand Canal, the imperial capital at Peking in the food deficit area of north China was fed by water transport of rice from the food surplus area of the Yangtze delta. Elsewhere, large amounts of energy are expended in the utilization of natural waterways, as on the upper reaches of the Yangtze against a powerful current, because where it is available water haulage even under difficulties is cheaper than available overland carriers. Canals are old and extensive, especially in the Yangtze and Hsi deltas, and are a major factor in the economic life of most of the cities of the eastern lowland.

Porters, Pack Animals, and Carts

Human porters still probably carry the next greatest volume, despite the development of railways and their recent extension. In an economy still largely pre-commercial, small-capacity carriers with low fixed costs and with consequent flexibility have on these grounds a logical place. In some areas porters remain the major transport medium. With the aid of the carrying pole and other simple weight-handling devices, plus highly developed senses of balance and rhythm, individual loads

[4] The writer was in China from early 1943 into 1946, much of the time engaged in transport activities, on the Burma Road and other roads, and on rail and water routes. Some of the following material is drawn from that experience.

often exceed 150 pounds, and may be carried 30 miles a day at a slow dog-trot. In the West, where the art of human labor has largely been forgotten, this may appear incredible or freakish, but it is typical of most pre-industrial situations. In such situations, perhaps a majority of transportation is undertaken by the local producers themselves, or by local human carriers, in the short hauls characteristic of an areally limited exchange, rather than by large transport organizations.

Despite its logical place in China and its accomplishments, porter transport is by far the most expensive carrier in present use, as it usually is everywhere. It is certain that rates frequently exceed the equivalent of U. S. $1.00 per ton/mile, and seldom if ever fall below $.60. Another major disadvantage, in terms of economic development, is the limited range of porter transport for any but high unit-value goods, of which tea is a good example. In general, while transport routes were highly developed in traditional China, only high unit-value or strategic goods (salt, silk, iron, copper, cotton, pottery, tea, opium, art objects) moved more than a few score miles, aside from the tribute shipments of rice, which were politically or strategically rather than economically conceived and managed and which put a serious strain on the economy as a whole. Finally, apart from its costs and limited range, porter transport could never move goods in a volume which could adequately encourage regional specialization.

Man-power carts came into wide use with the building of motor roads. Carts pushed and pulled by three or more men, who also acted as brakemen going downhill, were mounted on two wheels and carried up to one and a half tons, at ton/mile rates which were considerably lower than the porters'. They hauled a large volume of goods on the roads of west China during the war against Japan, many of them military supplies on military orders.

Pack animals are universal carriers in rough country without roads, and they are still used to a great extent in China. The animals are mainly horses, but mules and camels are also used in much of the arid north and northwest, while yaks are the dominant carriers in Tibet. Loads are only a little heavier than those carried by porters (the pack horses are small, like the famous Mongol ponies), but the range is greater and more ground can be covered in a day. If they are fed grain, animals eat as much in proportion to the load they carry as do the porters, but animals can be supported on a forage basis along routes where forage is available. This is related to the fact that animal transport is most common in areas where grass or waste land is widespread, and is of relatively small importance in the highly cultivated rice areas, where porters handle most of the overland transport. Pack animals use the motor roads where the road follows a direct route, but stick to pack trails where the road deviates to keep within grade limits, or where roads are absent. Ton/mile rate equivalents compete favorably with those for truck transport.

The cheapest non-mechanized overland carrier is the animal cart. Rates in the 1940's, especially for the four-animal cart (most common in the north and northwest, where mules were mainly used), compared favorably in some cases with first class railway rates, although the average was higher. The concentration in the north is explained by lower relief and by the lack of waterways. The improved type of cart developed during the 1940's to use motor roads to best advantage was mounted on two truck axles with rubber-tired wheels on

free-turning bearings and carried loads of one to three tons. This was very little less than the loads carried by motor trucks, and was made possible primarily by the light weight of the cart empty. The carts may cover 80 miles a day in flat or rolling country and about half that in hilly country, but their daily mileages were more consistent than the trucks' under wartime conditions, and on a monthly average probably amounted to nearly the same.

Motor Trucks

It will be evident from the foregoing that motor trucks are by no means the only or even the most important users of many of China's highways. Truck rates varied in the 1940's approximately from the equivalent of U. S. $.30 to $.60 per ton/mile; it is hard to see how under present conditions these rates (or the costs which they reflect) can be reduced to a point where trucks can compete on a large scale with other carriers in bulk haulage. Costs are high because of the acute shortage and high price of liquid fuel, original equipment and replacement parts, the poor condition of the roads (especially in the rough country which covers most of China), the shortage of trained technicians, and the small capacity of the carriers.

China has a very small domestic production of petroleum or refined gasoline. Some small pools have been discovered, most importantly in Szechuan, Shensi, at Suchow in Kansu, and in Hsinkiang. Production is probably greatest at Suchow, but is still minute in comparison even with China's needs. The geological possibilities are against any major new discoveries, though the Communist government has announced several, without giving figures or exact locations. The importance of these may be doubted also because the government continues to expand facilities for working the Manchurian oil shales, overlying the Fushun coal seams, which produce very high-cost fuel, in amounts which do not seem adequate even for current needs.

Under the present virtually blockade conditions, domestic fuel shortages impose a sharp limit on truck transport. On the other hand, imports of petroleum from southeast Asia would have to be paid for by an economy likely to remain for many years deficient in foreign exchange. China has now begun to produce her own road vehicles, in Manchuria, but the volume of this production must remain small for many years to come, and its costs high. Imports from Japan, if they became possible, would pose the same problem of foreign exchange and of competing industrial demands.

The road network as of the Communist take-over in 1949 was not an adequate basis for volume haulage. Most of the roads were 20 feet wide or less, and none were paved except within the large cities. Some were well surfaced with crushed stone and well drained so that they could be used at all seasons, but most were unusable for two or three months out of the year. This is especially true in north China where road building is easy in flat or loess-covered country but where the road is often no more than a beaten track which becomes a morass during the rainy season. In the absence of adequate water transport and the sparseness of railways, movements of goods often come to a stop in this period.

In mountainous or hilly south and west China, navigable waterways and railways are also limited or absent, and the low capacity of the roads, plus rainy season interruptions, is a critical problem. Grades were officially limited to 8 per cent, but frequently exceed this limit on short stretches, and stalled

trucks block the road. Where the original slope approximated 8 per cent, little effort was made to lay out an easier grade. Curves are frequent and steep, to the extent that no trailer trucks could be used. Few trucks with more than a three-ton rating could manage these roads, and loads almost never exceeded five tons.

THE EXAMPLE OF THE BURMA ROAD

The Burma Road, so-called, from Wanting on the Burma border to Kunming and on to the war-time capital at Chungking, was a representative sample of existing motor roads in China. It was 15 to 20 feet wide, surfaced with crushed stone in places and stamped earth in others, reasonably well drained, crossed some of the most notable gorges in the world and also traversed rolling and flatter country; and had a maximum official grade of 8 per cent and a maximum actual grade closer to 10 per cent, a minimum curve radius of 50 feet, and passed through several cities as well as through both productive and non-productive regions. It was built entirely by human labor and dynamite, the labor being conscripted (often without pay) from each locality through which the road passed. It was thus completed more or less simultaneously in sections, and the entire distance from Wanting to Chungking (approximately 1200 miles) was finished in about one and a half working years between 1935 and 1938.[5]

It was designed as an all-weather road, but the heavy rainfall especially of the area west of Paoshan (approximately 60 inches falls in heavy showers during June, July, and August) frequently closed the southwestern quarter of the route during the rainy season because of landslides or washed out bridges. The old imperial post road system, traditionally "good for ten years and bad for ten thousand," branched from west China to Burma along approximately the same route as the motor road. Before the advent of the motor road, this route carried a fair volume of high unit-value goods between Yunnan and Burma, with connections at either end for Szechuan and India: silk, tea, opium, drugs, salt, cotton thread. The role of the new motor road was suggested by the fact that many of these goods continued to move by pack animal or by animal carts.

Like most of China's highways the Burma Road was built to serve an emergency need, in this case the Japanese blockade of Free China, in other cases local famine, bandit suppression, or civil war. The goods which moved on it from its opening in 1938 until the end of the war in 1945 were military cargoes hauled for strategic rather than economic reasons by two large government-subsidized trucking companies and numerous individual operators who found that the very high rates and opportunities for smuggling often paid for the cost of the truck in one round trip. About a quarter of the total goods hauled was fuel for use of the trucks en route.

Total monthly haulage was about 15,000 tons in 1939, but traffic and maintenance problems reduced this to about 10,000 tons in 1940, and American trucking experts were called in to step up the flow. With their assistance, monthly haulage rose to an average of about 20,000 tons for the remainder of the period from 1941 to 1945. It is clear from these figures (about a quarter of the total was fuel and spares) that truck transport never became an important factor in supplying war-time

[5] See L. C. Ting: "The Yunnan-Burma Highway," *Hsin Ching Chi*, November 16, 1938 (in Chinese).

China, despite the money and efforts invested in it and despite the urgent situation. Ton/mile rates rose to the equivalent of U. S. $.60 toward the end of 1940, and remained at about this figure for the remainder of the war. Non-strategic materials were excluded from truck haulage, but when the restrictions were relaxed just before the end of the war, porters, pack animals, and animal carts continued to carry a large amount of the goods moving along this route.

The experience of the Burma Road would tend to suggest that roads are an inadequate solution to China's transport problem, given existing physical and economic conditions, despite the low initial cost for right of way and the speed with which roads can be built even without mechanical equipment. Under these conditions, it is not surprising that truck haulage has never made a significant impact on the economy in any part of China. Under any conditions, trucks are not cheap volume carriers as compared with railways, and industrialization or commercialization on the scale at which the Communist government aims cannot depend upon them. In general, the larger the capacity of the carrier, the lower the unit haulage cost. This means railways or waterways rather than roads.

Railway Development

In a capital-poor country like China, the heavy capital investment necessary for railways is a major obstacle to the development of transport. This investment is economic only where the line can count on a high and constant volume of flow, for only thus can it meet its fixed costs. Such flow conditions are not characteristic of a largely subsistence economy as China's still is, except under special local or regional circumstances.

The present rail network was built entirely since 1888, and is for the most part a legacy of the West's investments in China's economy during the imperialist period from 1890 to 1914. By 1914 foreign capital had built the lines connecting Tientsin, Peking, Mukden, Tsingtao (Chingtao), Hankow, Shanghai, Nanking, Kaifeng, and Sian, and had begun work on the line from Hankow to Canton. There were thus two major north-south lines and one east-west line. During the same period, the line from Peking to Paotow in Suiyuan was built as an all-Chinese enterprise, and the French completed their narrow gauge line from Haiphong to Kunming. By 1937, with the beginning of the Japanese war in China proper, the Chinese had completed the line from Hankow to Canton, had joined Changsha on this line with Shanghai and Nanking via Nanchang, and had extended this new east-west route in the south as far west as Kweilin and Liuchow.

In its major outlines (see Fig. 1 for details) this was the railway pattern inherited by the Communists. By 1951, war and civil war destruction had been made good, and several new lines built or begun. Rails and rolling stock are now being made in Manchuria, but it does not seem likely that war losses have yet been completely restored, especially given the considerable new mileage built since 1950. Pre-Communist rail mileage in China (exclusive of Manchuria, which is a different story)[6] totalled about 6000 miles, and represented only the smallest beginning of an adequate network in a country of this size and population. It will be useful to summarize statistically the

[6] See Norton Ginsburg: "Manchurian Railway Development," *Far Eastern Quarterly*, August, 1949, pp. 398–411. The article includes a map.

operation of this system as of 1936, the last "normal" pre-war year (Table I).[7]

The relatively small importance of agricultural products in this agrarian country reveals the lack of long-distance marketing of these products (and vice versa), and is also explained by the lack of railways in many of the rich agricultural areas. Forest products are of course unimportant in the Chinese economy as a whole. Products of animals hauled by the railways were almost entirely hides and wool, and their small importance in these figures is again a reflection of local markets and of the absence of railways in the major grazing area of the northwest. The high place of manufactured goods reflects their ability to pay railway rates, their need for bulk shipments, and the concentration of the rail net in the more industrialized eastern lowland. Government cargoes were mainly military goods and personnel, but the actual figures were probably higher even for the peace-time year of 1936, and may have been scaled down by the Ministry of Communications for public consumption. Goods for service and maintenance are not usually included in conventional haulage figures; as the third largest haulage item, they suggest a disorganized administration and a badly run down plant. The high place of passenger revenues is a result again of the network's concentration in the more urban and densely populated eastern lowland, and of the low volume of freight hauled for the country as a whole.

TABLE I

STATISTICAL SUMMARY OF MOVEMENT ON CHINESE RAILWAYS IN 1936

Products of	*Metric tons carried (per cent)*	*Ton/miles hauled (per cent)*	*Revenue (per cent)*
Mines	56	54	28
Agriculture	14	16	14
Forests	1	0.2	1
Animals	1	0.8	3
Manufacturing	12	10	14
Government cargoes	4	8	4
Goods for service and maintenance of railways	12	11	3
Passengers	...	.....	33
	100	100	100

Even with the inclusion of government and service-maintenance haulage, products of mines are the outstanding cargo. About 80 per cent of this was coal, which moved primarily to extra-local markets and relied heavily on rail transport. It was less inconvenienced by poor equipment, and was produced in relatively high constant volume, easily handled in bulk, at several points along the lines (most importantly in Hopeh, Shansi, and Shantung). Coal was responsible for the building of the first railways, in the north, and its continued dominance is characteristic of the early stages of rail development in a still incompletely industrialized economy.

ECONOMIC PROBLEMS OF RAILWAYS

These figures present a picture of an essentially unbalanced rail network which could not serve more than a small part of China's transport needs. Lack of regular volume, added to inefficient operation and poor equipment, kept costs high in a vicious circle which was hard to interrupt. Average length of haul per ton was only about 110 miles, as against 224 for the United States at this period. Average loads per train were, however, relatively high, due presumably to the large importance of coal: 270 tons as against approximately 600 tons for the United States at that period and 210 for the United Kingdom. Total yearly haulage by the Chinese railways averaged about four and a quarter billion ton/miles in the

[7] Data from *Chinese National Railway Statistics*, Nanking, 1936 (published annually by the Ministry of Communications).

years immediately before the war, as against about 335 billion ton/miles carried yearly by American railroads during the late 1930's. Railway rates ranged from the equivalent of U. S. $.01 per ton/mile to $.10, depending on length of haul and nature of cargo. On the trunk line from Peking to Hankow rates averaged about $.05, and on a national basis about $.035. These are high figures for rail transport (in the United States at this period ton/mile rail rates averaged about $.01), and reflect a low and fluctuating volume of traffic.

Railways did not adequately serve the four main routes of agricultural goods moving to extra-local markets as they then existed: rice and wheat from Hupeh, Hunan, Kiangsi, and Anhwei to the coast; t'ung oil, eggs, silk, and hides from Szechuan to the coast; hides, skins, and wool from the northwest to north China ports and to Shanghai. Where lines did run through these areas, they tended to carry only small amounts of these goods.[8] The effect of railway building in the less industrialized areas before 1937 was discouraging. The French line from Haiphong to Kunming, for example, was completed in 1910, but after 30 years of operation its total annual haulage averaged only about 270,000 tons.[9] The conclusion to be drawn from this is that railway development in China could not economically be done in advance of economic development on a level adequate to sustain railways. Low-cost volume transport facilities are an essential part of such a development, but they cannot wholly precede nor produce it.

Railway building in China has not in the past been able to create *de novo* the kind of economic conditions conducive to profitable railway operation. Rapid expansion of mileage under such circumstances may outrun general economic development too far and become a heavy charge on an economy inadequately equipped to use it. In this light, Communist emphasis on railway construction on a very large scale, in advance of the effective commercialization of the economy, may pose problems even for a totalitarian system. Capital is crucially scarce in China, and it may be questioned whether it is wise to concentrate its investment so heavily in a type of development which normally accompanies or follows other economic growth rather than preceding it.

As a still largely subsistence economy, China is in a very different position from the United Kingdom or the United States in the great age of nineteenth century railway building. China cannot, as they did, build railways rapidly and profitably in an expanding and already highly developed commercial-industrial economy, with a mounting capital surplus. Nor can China expect from railway building the same catalytic effect on economic development, since her own economy is in such a different stage to begin with.

Communist Planning

The Communist government has given industrialization top priority in its planning, and has apparently assumed that massive railway building is a first rather than an accompanying step. Figure 2 gives some measure of the magnitude of this project.[10] As a Communist government, it is to some extent in a position to disregard normal economic considerations, as the Soviet planners have repeatedly done in Russia, but the shortage of capital never-

[8] *Chinese National Railways Statistics*, *op. cit.*

[9] Chi Ch'ao-ting, *The Wartime Economic Development of China*, Institute of Pacific Relations, New York, 1941 (mimeographed), p. 246, and *passim*.

[10] For further details, see G. B. Cressey, *op. cit.*

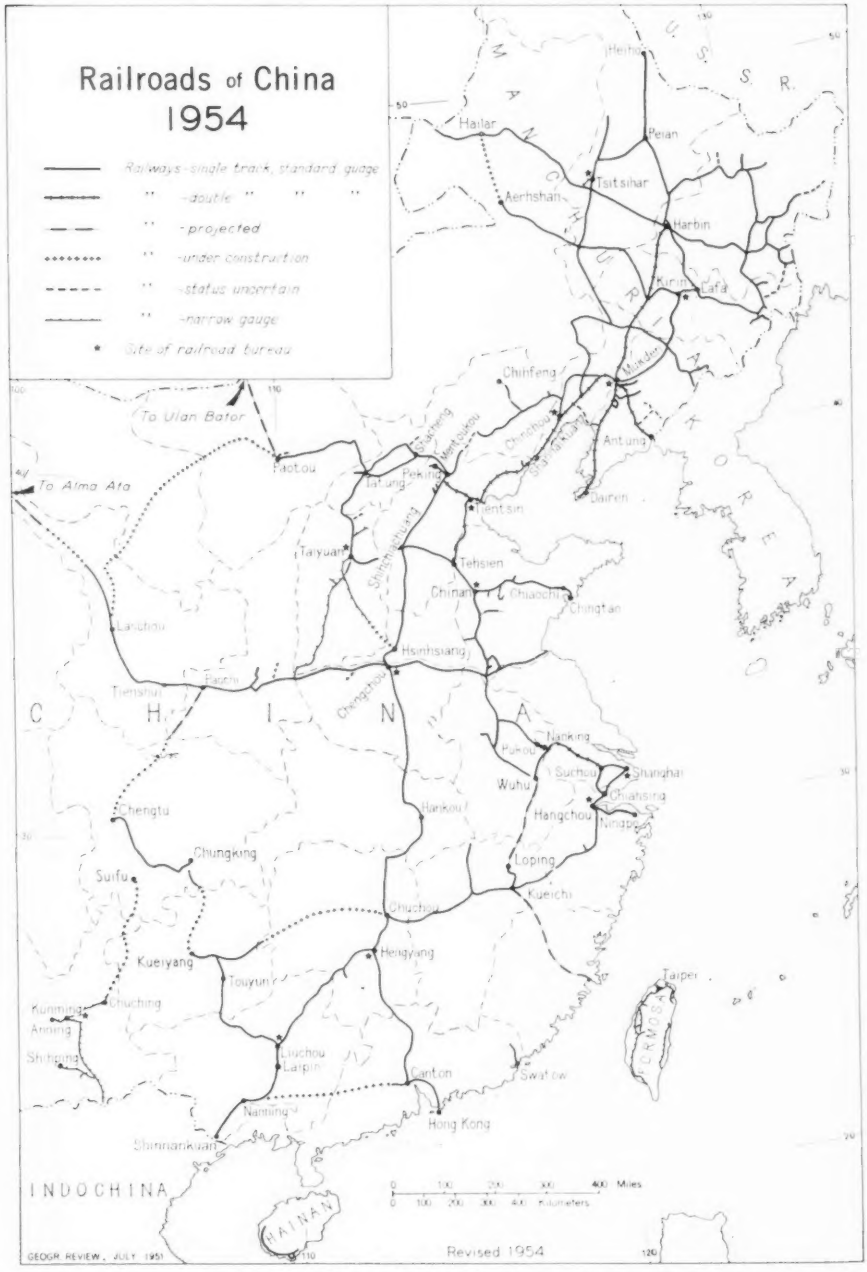


FIG. 2. Railways of China in 1954. Routes of some of the lines proposed or under construction are not known exactly. Precise information on other new or current lines is difficult to obtain. Original map by courtesy of the *Geographical Review*, revised 1954.

theless imposes limits, and should encourage a more careful attention to economic realities. At least two of the new or proposed routes seem predominantly political or strategic in character; the line into Hsinkiang (to connect with the Russian Turk-Sib railway at Alma Ata), and the line into Mongolia, via Ulan Bator (Urga), to connect with a spur from the Trans-Siberian at Kyakhta on the border. How much Russian capital may be made available for this building is not clear, but in view of Russia's own capital shortage and pressing demands it could not be very substantial. The recent Sino-Soviet agreement of October, 1954, specified that the Hsinkiang and Mongolia lines were to be built by the Chinese, presumably in part because direct Russian participation might have unfortunate connotations in China.

In any case, this is a heavy investment in strategy, and one which cannot for many years if ever be expected to pay economically. The productivity of Hsinkiang and Mongolia is too low, even with the stimulus of a railroad. It is over 1600 miles, almost entirely through desert, from Lanchow to Alma Ata, and over 700 from Paotow to Kyakhta. Economically unproductive mileage on this scale could be a critical drain on the industrialization process rather than an aid to it. The new lines planned from Paotow to Lanchow and from Chengtu to Tienshui are presumably to feed into this new alignment of transport toward the Soviet Union.

The logical direction of transport flow in China is, in broad outline, to and from the coast, and secondarily between north and south. This is the trade pattern which best reflects regional and international complementarity, and which is fortunately already served by the great river systems and the coastal sea route. The great bulk of China's population, markets, and production lies east of Lanchow or Chengtu and south of the Great Wall (aside from Manchuria). Lanchow is closer to the coast than to any part of Russian territory, and very much closer to Tientsin or Shanghai than to Alma Ata. Physical proximity to the coast is buttressed by the more productive nature of the country through which the route passes, as compared with Hsinkiang.

For obvious political reasons, the present government is attempting to change this orientation, to build up the northwest and its trade at the expense of the coast, and by constructing railroads through its landward border zone of desert to strengthen China's link with the Soviet bloc. Even if this should become a permanent and exclusive alignment, it could never be as economic, across the longest land route in the world, as China's river- and sea-based connection with the markets available from her east coast. Complementarity with the Soviet bloc is much stressed in the government-controlled press, but it cannot possibly offer to agrarian but industrializing China (i.e., in a position not very different from Russia's) the capital goods or trade potential of her normal trade partners. Japan, western Europe, and the United States offer a much more substantial complementarity, and transport connections with them are or could be superior in every way to a desert railway across the breadth of Eurasia. If the present Sino-Soviet alignment should lose some of its inflexibility and allow China to widen her trade relationships, the investment in railways in Hsinkiang and Mongolia and the forced re-orientation of China's transport patterns would become doubly and disastrously wasteful.

Precise information on Communist road building is more difficult to find, but there has been much fanfare in the

Chinese press about the completion of a "jeep" road from Tatsienlu (near the western border of Szechuan) to Lhasa. Its significance is obviously strategic rather than economic. Elsewhere the government is carrying out an extensive program of road building, including the improvement of existing roads as well as the construction of new routes. While this is a useful step in the right direction, the shortage and high cost of fuel and equipment, the nature of even the new roads, and the inherent limitations of truck transport will not make of it a major solution to a transport problem of China's dimensions. Land distances in China are great, and truck transport is thus doubly unsuited to act as a low-cost volume mover.

There is a considerable prestige factor involved in railway building, in a China desperately anxious to catch up with the West and under the control of an emotionally nationalist government. This may lead the present regime into many uneconomic ventures. Improvements in waterways are not being neglected, as evidenced by the multipurpose Huai River reclamation project and work on several other north China rivers, as well as on certain sections of the Yangtze. Viewed in economic terms, however, it might be argued that scarce capital in China would best be invested, in these early stages of industrialization and commercialization, predominantly in water transport. With China's natural advantages in this respect, more widespread and more efficient mechanization of water carriers and improvement of existing water routes might have better economic logic than the present heavy emphasis on new railroads. The example of the Rhine, which still carries more traffic than the combined railways through its basin (and at lower cost) should be suggestive to China, where the Yangtze system is larger and at least equally well placed to serve a majority of the domestic and export flows. Animal carts also should not be neglected. This is a less glamorous program, but perhaps a more efficient or effective one, than the impressive present plans. The manifold disappointments and heavy unprofitable investments in railway building in the past in China should provide a warning even to Communist economic planners.

THE TRAFFIC PATTERN ON AMERICAN INLAND WATERWAYS*

Donald Patton

Dr. Patton, Associate Professor of Geography at the University of Maryland, has specialized in the geography of transportation.

AID to navigation has been one of the major purposes of annual federal expenditures on certain waterways within the United States. This long-term policy of waterway improvement and maintenance has made modern motor ship and barge transport feasible on rivers which otherwise would have remained unnavigable. By the middle of the twentieth century the annual ton-miles of transport service performed on the waterways far surpassed the volume moved in any earlier period, even including the pre-railroad era when waterways were the chief carriers. The construction of locks and dams to stabilize and deepen the waterways, along with channel dredging, have been in part responsible for this traffic increase. The upswing in total traffic tonnage has occurred mainly since 1925.

An overall view of where waterway traffic has developed and where it has failed to develop appreciably is appropriate, together with some analysis of factors responsible for the differential development of traffic. Statistics of the overall density of traffic on individual rivers are almost meaningless because of major variations of traffic flow from point to point. Consequently, a map of traffic flow has been prepared in order to summarize the traffic density pattern for all parts of the inland waterway system of the United States. Traffic flows on individual waterways or sections of waterways can thus be compared to those on all other major waterways. Problems and policies of waterway improvement inevitably must be concerned with the large traffic density variation that exists within the improved waterway system of the United States.

THE MAP

The map of barge and raft traffic on the rivers and canals of the United States has been compiled for the year 1949, showing total traffic flow in tons in each direction wherever waterways have a yearly traffic volume of at least 10,000 tons in either direction. At the time the study was begun, 1949 was the latest year for which complete figures for waterway traffic were available. Subsequent study of statistics for the years 1947–1953 indicate that 1949 is substantially representative of the post-World War II situation on the inland waterways. The map is restricted to *bona fide* river and canal traffic and excludes all sea-going traffic that may penetrate lower stretches of rivers to reach river ports. On the same basis the map excludes coastwise traffic[1] and Great Lakes–St. Lawrence traffic, as well as raft traffic on Puget Sound.

*The author was aided in the research for this paper by Office of Naval Research funds made available through Dr. Edward L. Ullman.

[1] Traffic through the 27-foot Chesapeake and Delaware Canal is essentially coastwise traffic hauled in sea-going vessels.

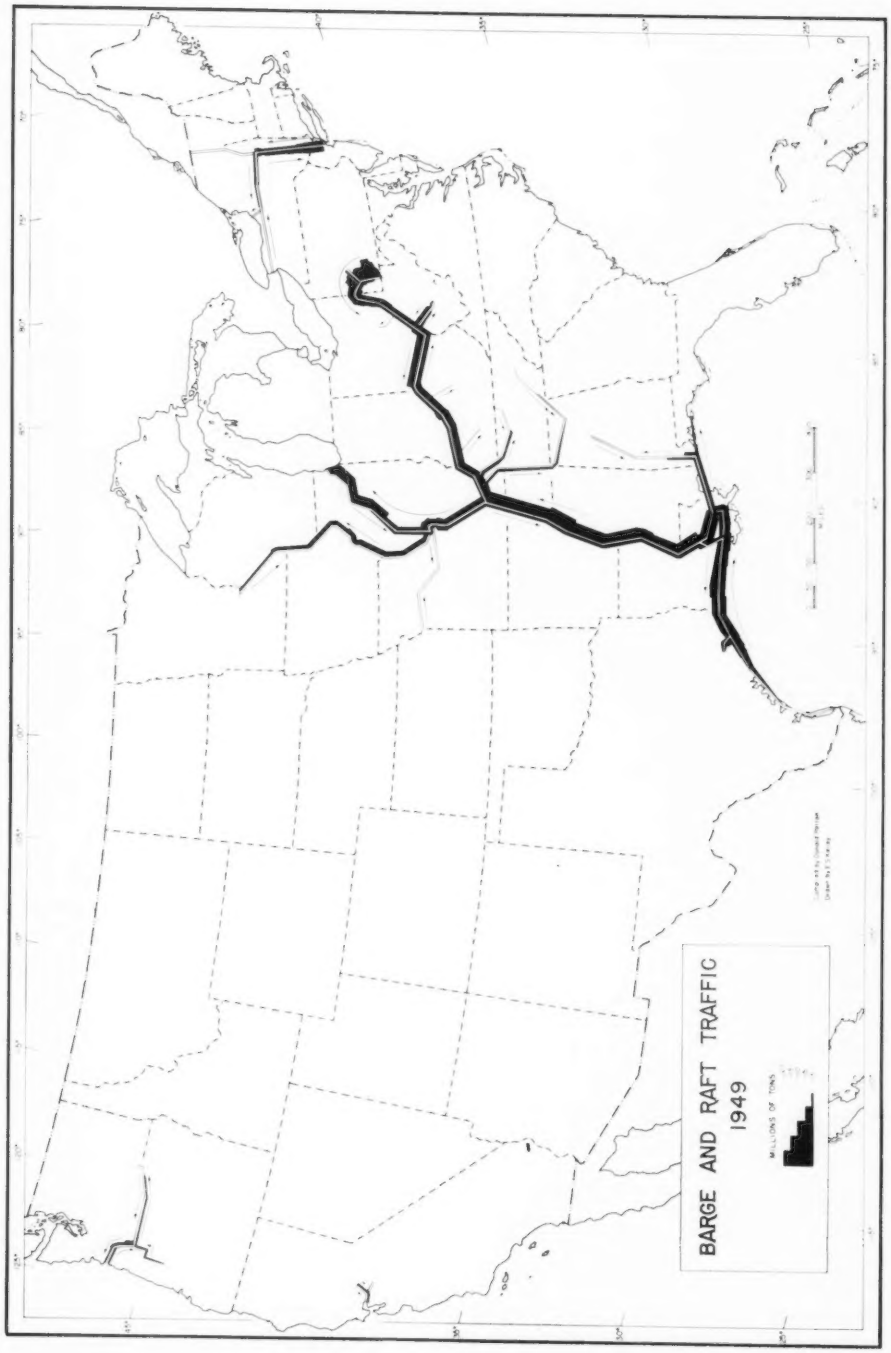


FIG. 1.

Barge traffic accounts for practically all inland waterway traffic; raft traffic is significant only on the Columbia and Willamette Rivers.

SOURCE DATA FOR THE MAP

For the most part the statistics and other information used in making the map were furnished by the Board of Engineers for Rivers and Harbors, Department of the Army. Much information was obtained from the Annual Report of the Chief of Engineers, but statistics were furnished, also, by the district field offices and the Washington office of the Board of Engineers. Tonage graphs for the Ohio River and each of its major navigable tributaries, compiled in the district field office of the Board of Engineers, have also been of inestimable help in detailing the complex movements particularly of the upper Ohio and the Monongahela. A large amount of information was supplied, too, by shippers and carriers on the waterways. Field observations and direct experience along most of the major waterways aided in the interpretation of statistics. The total available statistics were not adequate to report traffic flows with perfect accuracy, but it is estimated that the margin of error for most of the map probably does not exceed 10 per cent and is well under 10 per cent for the Ohio River system, the Illinois, and the upper Mississippi.

IMPORTANCE OF INLAND WATERWAY TRAFFIC

Barge traffic over America's rivers and canals comprises about 6 per cent of the total ton-mileage of all national traffic, excluding coastwise and intercoastal trade. Its national importance is thus seen to be relatively low, but since the inland waterway traffic is confined to a small number of routes the actual traffic density[2] over numerous sections of waterway is in excess of 5,000,000 tons per year. For a number of years the highest traffic density, about 18,000,000 tons a year, has been along the lower or northern half of the Monongahela River, one of the more important inland waterway traffic arteries of the world. By way of comparison, this is equivalent to about 63 per cent of the tonnage passing through the Panama Canal.

GENERAL TRAFFIC FEATURES

American inland waterway traffic usually consists of fleets of six to twelve barges, carrying primarily bulk products but including an array of smaller package freight. Such barges move over waterways with a minimum depth of nine feet.[3] Total traffic flows as mapped are made up of numerous overlapping long, medium, and short hauls performed by contract, private, and common carriers. Terminal operations are effected by modern mass-handling equipment. The mineral fuels, coal and petroleum, are far in the lead in tonnage (and value) and comprise over 90 per cent of the total traffic flow as shown on the map. In some instances other types of cargo comprise a third of the total flow; much more rarely they may even dominate the traffic.

Two major traffic originating areas are all-important for waterway traffic: the Appalachian coal fields and the Gulf Coast petroleum province. Appalachian coal moves out rather widely, but not beyond the mouth of the Ohio, whereas petroleum dominates traffic flows throughout much of the Mississippi River system and the Gulf Intracoastal Waterway. Large metropolitan areas

[2] Which may be thought of as the number of tons passing a particular point during the course of a year.

[3] A few rivers used by barges are shallower, but the amount of traffic moving on such shallow waterways is negligible.

reached by the waterways receive great quantities of petroleum products or coal, or both, along with some miscellaneous cargo, and originate some river-shipped manufactures.

COAL TRAFFIC

Barged coal accounts for the greatest traffic density[4] on the inland waterway system, but on a ton-mileage basis coal is surpassed by crude oil and refined oil products, which have a considerably longer average haul. Coal traffic is conspicuous on the Monongahela, lowermost Allegheny, upper and middle Ohio, Kanawha, and much of the Illinois Waterway.

Firmly entrenched and an integral part of intracorporation production of iron and steel is the northbound barging of coal from iron and steel company mines along the Monongahela to by-product coke ovens in the Pittsburgh area and the upper Ohio Valley. Some of the Monongahela River coal-loading terminals are reached via underground belt conveyances leading from mining areas a few miles back from the river. The map shows the scant importance of coal traffic on the uppermost 20 per cent of the Monongahela, where a minimum depth of only seven feet and lock chambers too small to contain the larger barges used downstream thwart traffic development. Farther downstream on the Monongahela step-like increases in downbound coal traffic occur as successive, closely-spaced loading terminals are passed. Batteries of coke ovens at Clairton, ten miles south of Pittsburgh, are the largest single terminal for northbound traffic. In sharp contrast to the Monongahela, the Allegheny has only a few major mines adjacent to the lower course of the river, and funnels only a small volume of coal toward the Allegheny-Monongahela convergence at Pittsburgh.

Downbound coal past Pittsburgh continues as far as Wheeling, but more significant is the coal movement that diverges up and down the Ohio from both the Kanawha-Ohio confluence and the rail interchange at Huntington, West Virginia. The upbound traffic segment between Huntington and Pittsburgh on the map is dominantly coal and has been growing rapidly since 1945, reflecting the exhaustion of some of the Monongahela mines of the iron and steel companies and reflecting also the long range gradual increase in relative importance of the Southern Appalachian field in southern West Virginia and contiguous parts of Virginia and Kentucky as compared with the Northern Appalachian field centered in southwestern Pennsylvania. The downbound Kanawha traffic is mostly coal, yet the volume is moderate since the navigable portion of the Kanawha does not extend far enough south to reach areas of high coal production. An alternate coal route to the Ohio for subsequent barge shipment leads via the Chesapeake and Ohio Railroad to Huntington. Coal accounts entirely for the downbound increase in traffic on the Ohio River shown on the map for both the Kanawha confluence and Huntington. This coal traffic leaves the river almost entirely at Cincinnati.

River-rail coal transshipments occur significantly at the two most pronounced northerly bends of the Ohio, one 30 miles downstream from Pittsburgh,[5] the other at Cincinnati. In both cases the drop in downbound traffic in a downstream direction is due to coal which leaves the river to continue in its general direction of movement by rail. Northeastern Ohio, and southeastern and central Indiana, respectively, terminate the ex-river coal. At

[4] Expressed on the map by the thickness of the flow lines.

[5] At Colona, Conway, and Smiths Ferry, Pa.

the apex of the pronounced southerly loop of the Ohio at Huntington, West Virginia, a reverse rail-river transshipment occurs where the Ohio approaches closest to major source areas for coal in the Southern Appalachian field. A major change in the direction of the river's course is thus seen to affect traffic flow.

Southwest of Cincinnati downbound coal traffic virtually ceases. Appalachian coal is unable to penetrate farther toward the Eastern Interior coal province, except for small coal shipments as far as Louisville for conversion into coke. On the Illinois Waterway, however, the shipment of coal from south central Illinois to Chicago, for use chiefly in carbo-electric plants, can be seen by the sharp increase in upbound traffic about 100 miles north of the Illinois-Mississippi confluence. Coal traffic from Mississippi River terminals in southern Illinois to Wisconsin and Minnesota constitutes about one third of the upbound traffic on the upper Mississippi.

PETROLEUM TRAFFIC

South and west of Cincinnati, and south of the lower Illinois, the transport of crude oil and its various refined products, particularly gasoline, collectively constitutes much of the total traffic flow, about 75 per cent of the ton-mileage for the remainder of the Mississippi River System and the Gulf Intracoastal Waterway. The changeover in sustaining importance from coal to oil products is well illustrated by the Ohio. Immediately below Pittsburgh, coal has 16 times the tonnage of petroleum products; immediately upstream from Cincinnati, oil traffic equals 91 per cent of the volume of coal traffic; and along the lower Ohio below the Wabash confluence, petroleum traffic amounts to two-thirds of the total two-way traffic, and coal traffic is negligible.

The extensive sections of the total navigable waterways that are dominated by oil traffic indicate in general the long-distance movements from areas of excess production over market demand in the Gulf Southwest to areas of extensive market demand and inadequate supply in the upper Mississippi Valley, the Ohio Valley, and along some of their tributary waterways, such as the Tennessee and the Cumberland. The map shows the four to one preponderance of northbound traffic on the lower Mississippi between Baton Rouge and the Ohio confluence, most of which is accounted for by petroleum traffic. The continued predominance of upbound over downbound traffic along the lower Ohio, the upper Mississippi, and the lower Illinois is likewise due to oil shipments.

The Gulf Intracoastal Waterway originates part of the upbound Mississippi oil traffic; the rest originates either by pipelines-barge interchanges, as at Helena, Arkansas, terminus of a line from southwestern Arkansas and northwestern Louisiana, or at the lower Mississippi Valley refineries of Baton Rouge and Norco, Louisiana. The comparatively heavy traffic along the Gulf Intracoastal Waterway in Louisiana and Texas is seen on the map to be relatively evenly balanced, with as much westbound as eastbound tonnage, since most Gulf Coast refineries attract crude oil, in part by barge, from producing pools disseminated along the coast both east and west of the refinery sites. The refining industry at Lake Charles, Louisiana, for example, draws crude oil from as far east as the New Orleans area.[6] The products of the refineries

[6] Letter from Mr. G. L. Gano, Manager, Crude Oil Marketing and Transportation, Cities Service Refining Corp., Lake Charles, La.

may not return eastward over the same Waterway, but rather move out by tanker. Refined products move westward in part to waiting ocean-going tankers, to temporary storage in tank farms, or as a result of inter-corporation exchanges. Cross-hauling is most characteristic and voluminous along the western section of the Gulf Intracoastal Waterway, where most of the total traffic in each direction is petroleum products. Even on the Mississippi, however, the overlapping of market territories of different oil companies causes some petroleum to move *south* from the Ohio confluence toward Memphis and the lower Mississippi Valley.

East of the Mississippi Delta, the Gulf Intracoastal Waterway's traffic falls to a quarter of its volume farther west as the main Gulf Coast petroleum province and the Mississippi routeway to the north are left behind. Part of the much smaller traffic east to Mobile and Pensacola and north to Birmingham is composed of gasoline and fuel oil.

Crude petroleum shipments make up about a half of the total petroleum traffic along the Gulf Intracoastal Waterway and the section of the Mississippi below Baton Rouge. But the proportion of refined products (particularly gasoline) to crude oil becomes much higher northward and northeastward from there toward the upper Mississippi Valley, the Ohio Valley, and the navigable left bank tributaries of the Ohio, and crude shipments are entirely absent along the upper reaches of the Mississippi and Ohio systems. This appears to be due partly to the lack of refining along some of the waterways served, but more particularly to the superior competitive position of pipelines for moving large volumes of crude oil long distances toward fixed, market-oriented refining centers of the upper Mississippi and Ohio valleys. The refined products traffic characteristic of the upper Mississippi and Ohio River systems represents mainly a series of rather small-scale movements of gasoline and fuel oil, often irregular in timing, to scattered storage terminals, conditions under which barge transport may be competitive with pipeline transport.[7] From the oil field of southeastern Illinois and contiguous parts of Indiana and Kentucky, however, a small fraction of the crude petroleum production finds an outlet via barge to refineries in the mid-Ohio Valley.

Rapid year-to-year changes in the details of oil barge traffic are characteristic since the construction of new pipelines, the erection of new tank farms, the development of new market areas on the part of particular companies, or other factors may bring about changing shipping needs. Along any particular stretch of waterway, however, the changes are not ordinarily large enough to affect the overall picture of traffic flow.

Along the Mississippi between St. Louis and St. Paul, petroleum traffic has until now been upbound. Completion of a lateral pipeline to St. Paul from the Alberta–Lake Superior trunk line may bring enough petroleum down to the head of navigation on the Mississippi to cause a reversal of traffic, which would henceforth be downstream to the Wood River–East St. Louis refining center.

Gasoline and fuel oil shipments are components of total traffic flows on the Erie Canal division of the New York State Barge Canal System, and the Hudson, Columbia, Sacramento, and San Joaquin Rivers. Refined products move west along the Erie Canal toward Mohawk Valley points and western

[7] See Becht, J. Edwin, *Commodity Origins, Traffic, and Markets Accessible to Chicago via the Illinois Waterway*, pp. 102, 108–109.

New York State, toward which some petroleum products also converge from Buffalo. Gasoline and fuel oil constitute about half the Erie Canal traffic, and the bulk of the upbound Hudson traffic. Albany thus represents convergence of traffic from the Atlantic coast and from the interior; some cross-hauling occurs along the Erie Canal. On the navigable rivers of the Pacific slope, however, the refined petroleum products movement is inbound.

OTHER COMMODITIES

Along a few sections of the waterways, traffic other than coal or petroleum predominates. Rafting of logs easily leads along most stretches of the navigable Columbia and Willamette. Above the lowermost reaches of the Allegheny, downbound sand and gravel movements comprise the only traffic using the river. On the Hudson, where downbound traffic clearly outweighs upbound traffic, almost all of the increase in traffic southward from Albany is accounted for by crushed stone and brick. The products of quarries and brick works alongside the Hudson are hauled conveniently by water to New York City's voracious construction industries.

More numerous are the products which help to fill out the total flow as mapped. On a value basis most of them are of greater importance than on a tonnage basis. Semi-finished steel and finished iron and steel products move down the Ohio and to some extent into the Mississippi from the Pittsburgh steel district; most important of such products is pipe for the petroleum industry. Iron and steel products from Birmingham, Alabama, provide the mainstay for downbound traffic along the major part of the Tombigbee-Black Warrior system, while on the Illinois Waterway they are one of the leading segments of downbound traffic, and diverge from the lower end of the Illinois River to markets both up and down the Mississippi. Grain moves south from a score of terminals between St. Louis and St. Paul, some moving into the grain-deficient South via the lower Ohio and the lower and middle Tennessee; the rest continuing along the Mississippi below Cairo. The New York State Barge Canal system also makes a small contribution toward moving grain outward from the agricultural interior; grain ranks with petroleum in importance on the canal. Other agricultural staples, such as coffee and sugar, move up the Mississippi to Middle Western cities from the general cargo port of New Orleans. Sulphur, for a variety of purposes in the upper Ohio and Monongahela valleys, is barged northward from both Freeport, Texas, and the Port Sulphur district of the lowermost Mississippi Delta. Sand and gravel dredges, working river bottom deposits, originate sizeable traffic movements locally, and account for some of the local irregularities in the total traffic flow pattern, as on the Ohio between Evansville and Cincinnati. Sea shells scooped from coastal flats comprise a considerable part of the nonpetroleum traffic along the Gulf Intracoastal Waterway. Cement, slag, caustic soda, liquid chemicals, packaged foods, automobiles, and some miscellaneous manufactured products complete the list of main commodities forming part of total waterway traffic.

PROBLEMS OF TRAFFIC DENSITY

Heaviest traffic densities appear to develop where waterways offer relatively straight routes of adequate depth between important source areas of coal, petroleum, or quarry products and the immediate users of these products—the coke ovens, metropolitan carbo-electric plants, city factories, petroleum re-

fineries, intermediate gasoline distributing points, and urban building industries. The Monongahela, Hudson, western Gulf Intracoastal Waterway, lower Mississippi, Illinois Waterway, and certain segments of the Ohio best illustrate these conditions. The Illinois Waterway, in addition, appears to benefit from its position as the only waterway link between the Mississippi River System and the Great Lakes, with the possibilities of interchange from one type of water carrier to another in the Chicago area, where river, lake, and even shallow-draught ocean shipping operating via the St. Lawrence River anchor in the lower reaches of the Chicago and particularly the Calumet Rivers.

These considerations may be useful in assessing the reasons for the failure of heavier traffic to develop along some of the improved waterways. A useful comparison exists between the heavily traveled Gulf Intracoastal Waterway and the almost unused Atlantic Intracoastal Waterway extending southward from Norfolk, Virginia, to Florida, through coastal areas devoid of petroleum and other potential bulk cargoes. More interesting are the cases of the Tennessee and the New York State Barge Canal System. Depth is adequate on both waterways. The relative importance of the factors underlying the light traffic density on the Tennessee cannot be assessed with certainty. Little coal and no petroleum shipments originate on the river. Nor does the river pass major cities which might attract the upbound shipment of a number of raw materials. Possibly the actual course of the Tennessee, and its spatial relationships with the Ohio and the Mississippi, may have some part in the situation. The cities along the middle and upper Tennessee, from Decatur, Alabama to Knoxville can be reached from the upper Ohio or the lower Mississippi only by a circuitous route. Under such circumstances the advantages for river shipments might well be less marked than elsewhere.

Traffic on the New York State Barge Canal System has not fulfilled expectations; traffic totals remain modest, and currently the Illinois Waterway averages traffic densities three to four times that of the Erie Canal section of the New York State Barge Canal System. The Erie Canal suffers long periods of closure due to freezing. Also helping to account for its lack of traffic are the large number of locks and the slowness of the passage, together with the supply of petroleum products to western New York State from the interior and to the Hudson Valley primarily through the port of New York, thus obviating the need of large scale shipment through New York State. The canal route itself produces little of a bulky nature possibly suitable for canal shipment.

CONCLUSIONS

Within the United States certain rivers and canals play a small but by no means negligible role in the transportation of the surplus products of the earth. Land transportation will necessarily continue to contribute the greatest amount of transport service needed within the country, but an essential place in the national transport economy seems to be assured to *a few* inland waterways which combine adequate depth and usable alignment with reference to areas or points of heavy freight origination and major bulk market points. Along these select, few waterways a steady expansion of carrier capacity and private terminal facilities is occurring. These waterways will probably stand out even more prominently on a traffic flow map some years hence. The rate of growth of traffic

on these routes during the last quarter century indicates that they will rank in the future among the more important traffic arteries of the country. The trend of the past quarter century also points toward increasing traffic diversity along these routes. These rivers and canalized rivers represent the few cases in North America where water transport, other than coastwise freighters and tankers or the special case of Great Lakes transport, is able to exist in the face of the general dominance of land transport.

Equally significant is the large number of waterways which, though with some improvements of their courses, contribute little to the movement of freight traffic in the United States. A major disparity exists between the length of improved waterways in the United States and the length of waterways that carry anything approaching an appreciable amount of freight, say four or five million tons per year. The cost of waterway improvement, of course, is usually charged toward more than channel improvement for navigation. The statistical determination of how much traffic a particular river must or should carry in order to justify the cost of the channel improvements expended upon it, moreover, would be difficult if not impossible to calculate. Even current traffic levels along some of the more heavily used waterways may not justify the expenditures for channel improvements that have been made, since statistical analysis can proceed from various premises the discussion of which is beyond the scope of this paper. The hard fact remains that waterway traffic development is not responding appreciably to navigation improvements along many waterways where improvements have been made. Many miles of improved waterways do not meet the minimum traffic specifications in order to be shown on the map. Studies of differential traffic development on various inland waterways would reveal some of the forces involved in the few cases of relative success and the more numerous cases of relative failure of rivers and canals as transport arteries in North America. Such studies would provide additional background information for the further development of public policy relative to American inland waterways.

A RURAL COMPONENT OF CENTRALITY APPLIED TO SIX SOUTHERN COUNTIES IN THE UNITED KINGDOM

H. E. Bracey

Dr. Bracey is a research fellow in the Department of Economics, University of Bristol. He is well known for his work on rural social organizations.

THE renewed interest in the function and importance of "central places" evinced by American geographers[1] has encouraged the author to submit the following account of a survey carried out in southern England in 1953. It is an extension of his work in the county of Somerset,[2] which, itself, developed from an earlier survey published in a descriptive account of the neighboring county of Wiltshire which appeared in book form in 1952.[3] Arising out of the Somerset investigation, a simple procedure was devised for the assessment of what is termed in this article the *rural component of centrality*. This was applied throughout six counties in southern England, namely, Somerset, Dorset, Wiltshire, Oxfordshire, Berkshire, and Hampshire.

The survey area comprised some 7000 square miles and included a total rural population of, approximately, 998,000 and an urban population of 1,655,000. The area may be described as undulating countryside, much of which is less than 600 feet above sea level. The most considerable upland areas comprise the chalk of Salisbury Plain (in Wiltshire) and the Hampshire and the Berkshire Downs. In the north, in Oxfordshire, is a relatively small area of Cotswold country. In western Somerset lies Exmoor, where occasional heights of over a thousand feet occur, and here, indeed, much of the land is above 600 feet, population is thinly distributed, agriculture is marginal, and there are no sizable inland towns. The largest lowland areas are the Plain of Somerset, the Hampshire Basin, and the Vale of Oxford.

The survey area and its occupations can be described as predominantly rural. Agriculture consists mainly of mixed arable and grassland (principally dairy) farming. There are few industrial towns and cities, although many have important industrial functions; here may be named Reading, Oxford, Swindon, and the English Channel ports on or near the Solent. Bristol, administratively in Gloucestershire, is not included in the analysis which follows, but that part of its service area which falls in Somerset was surveyed. With few exceptions, notably the places listed in Table V, the towns in the survey area can all be described as country towns, although many embrace important industrial

[1] See, for example, John E. Brush: "The Hierarchy of Central Places in Southwestern Wisconsin," *Geogr. Rev.*, Vol. 43, 1953, pp. 380–402; and Raymond E. Murphy and J. E. Vance, Jr.: "Delimiting the CBD," *Econ. Geog.*, Vol. 30, 1954, pp. 189–222.

[2] H. E. Bracey: "Towns as Rural Service Centres," *Trans. and Papers of the Inst. of Brit. Geogrs.*, No. 19, 1953, pp. 95–105.

[3] H. E. Bracey: *Social Provision in Rural Wiltshire*, London, 1952.

TABLE I

Higher district centers: rural component of centrality and scores for services*

Center	County	Rural component of centrality	Service scores			
			Medical supplies and services	Business professions	Shopping	Entertainment
1 Taunton	Som.	284	56	58	84	86
2 Dorchester	Dorset	267	70	70	73	54
3 Salisbury	Wilts.	264	44	56	91	73
4 Yeovil	Som.	261	50	44	76	91
5 Newbury	Berks.	242	52	60	68	62
6 Banbury	Oxford	209	45	54	61	50
7 Oxford	Oxford	189	34	45	60	50
8 Andover	Hants.	185	42	46	48	49
9 Bridgwater	Som.	172	40	42	46	44
10 Basingstoke	Hants.	171	38	38	52	43
11 Devizes	Wilts.	170	34	39	55	42
12 Reading	Berks.	156	24	32	50	50
13 Winchester	Hants.	154	34	33	47	40
14 Swindon	Wilts.	147	21	27	46	53
15 Blandford	Dorset	131	31	30	33	37
16 Bath	Som.	130	24	29	41	36
17 Chippenham	Wilts.	128	29	30	36	33
18 Bridport	Dorset	119	27	25	35	32
19 Frome	Som.	107	25	25	27	30
20 Petersfield	Hants.	101	18	19	37	27
21 Witney	Oxford	97	22	20	32	23
22 Sherborne	Dorset	97	24	22	28	23
23 Wimborne Minster	Dorset	95	21	28	23	22
24 Alton	Hants.	89	24	22	24	21
25 Minehead	Som.	84	17	16	21	29
26 Trowbridge	Wilts.	83	16	18	26	23

*One point is scored to each center for each village using it for each service. The maximum village score is 4 points which may be allotted to one center or divided between several. (See pp. 40-41.)

functions also. There are, however, no large industrial concentrations.

Method

The information for the Somerset enquiry referred to above was obtained by the author from questionnaires which asked in each village and hamlet "which town or village is *visited*" for 15 different services. The method was unwieldly and a shorter alternative was clearly needed for use over a wider area. Detailed examination demonstrated that a much simpler scoring method, employing four items only, gave essentially the same results, and this was applied to a group of adjacent counties. Information for the remaining five counties, which are included in the following description, was drawn from the questionnaire sheets of the *Spheres of Influence Enquiry* which had been circulated by A. E. Smailes and Mrs. R. Fox from University College, London. The author of the paper, who is a member of the subcommittee of the *Geographical Association* which sponsored the *Spheres of Influence Enquiry*, is grateful for permission to use the information collected.

The returns showed that, in the United Kingdom, a center visited by country people for chemists' goods is also visited for all other medical supplies, dental treatment, and optical prescriptions, and, where there is no village doctor, for medical treatment at the doctor's surgery. This group has been termed *medical supplies and services*. In the Somerset enquiry *shopping* was treated in its various categories, but it is quite clear that, in general,

TABLE II

LOWER DISTRICT CENTERS: RURAL COMPONENT OF CENTRALITY AND SCORES FOR SERVICES*

Center	County	Rural component of centrality	Service scores			
			Medical supplies and services	Business professions	Shopping	Entertainment
27 Bicester	Oxford	82	23	23	18	18
28 Wantage	Berks.	82	22	22	19	19
29 Thame	Oxford	78	22	22	21	13
30 Shaftesbury	Dorset	78	19	19	19	21
31 Farringdon	Berks.	77	21	19	14	23
32 Chipping Norton	Oxford	74	18	16	17	23
33 Marlborough	Wilts.	68	19	20	17	12
34 Malmesbury	Wilts.	68	20	19	13	16
35 Warminster	Wilts.	67	20	18	12	17
36 Weston-s-Mare	Som.	62	10	8	21	23
37 Southampton	Hants.	60	5	6	29	20
38 Wells	Som.	60	14	14	17	15
39 Wincanton	Som.	60	15	14	12	19
40 Abingdon	Berks.	59	16	14	16	13
41 Henley	Oxford	56	14	14	13	15
42 Weymouth	Dorset	55	12	12	14	17
43 Pewsey	Wilts.	55	16	15	5	19
44 Sturminster N.	Dorset	55	18	21	16	..
45 Ilminster	Som.	54	14	19	11	10
46 Wareham	Dorset	52	13	17	14	8
47 Shepton Mallet	Som.	52	13	14	10	15
48 Calne	Wilts.	51	15	15	9	12
49 Wallingford	Berks.	50	11	14	12	13
50 Crewkerne	Som.	50	12	12	12	14
51 Chard	Som.	47	12	12	11	12
52 Romsey	Hants.	46	13	13	10	10
53 Wellington	Som.	46	14	11	9	12
54 Didcot	Berks.	40	11	9	8	12
55 Watlington	Oxford	40	13	11	5	11
56 Fareham	Hants.	38	2	6	15	14
57 Ringwood	Hants.	37	6	7	14	10
58 Norton-Radstock	Som.	35	8	11	4	12
59 Burnham-on-Sea	Som.	34	9	8	8	8
60 New Alresford	Hants.	34	13	11	2	8
61 Maidenhead	Berks.	32	7	8	9	8
62 Hungerford	Berks.	30	11	7	6	6
63 Glastonbury	Som.	29	8	8	8	5
64 Burford	Oxford	28	11	12	2	3
65 Gillingham	Dorset	28	7	9	5	7
66 Lymington	Hants.	27	7	4	10	6
67 Windsor	Berks.	26	5	6	9	6
68 Fordingbridge	Hants.	26	8	7	5	6
69 Castle Cary	Som.	26	7	6	6	7
70 Street	Som.	25	9	4	4	8

*For scoring method see foot of Table I.

all kinds of ordinary shopping is done in the same town or towns. The local auctioneer, accountant, and solicitor are usually found in the same center as the local bank, which can, therefore, be used as the indicating criterion for the group of *business professions*. The fourth item, cinema, was introduced as indicating the use made of a town for *entertainment*.

We have, therefore, four groups of provisions, namely shopping, medical supplies and services, business professions, and entertainment. The method of scoring follows. Each of the four services is allotted one point. Where, on the village questionnaire, one town is given as the *place visited* for a service, one point is scored to that center; if more than one center is named, then the point is shared equally between these centers. This method is one of

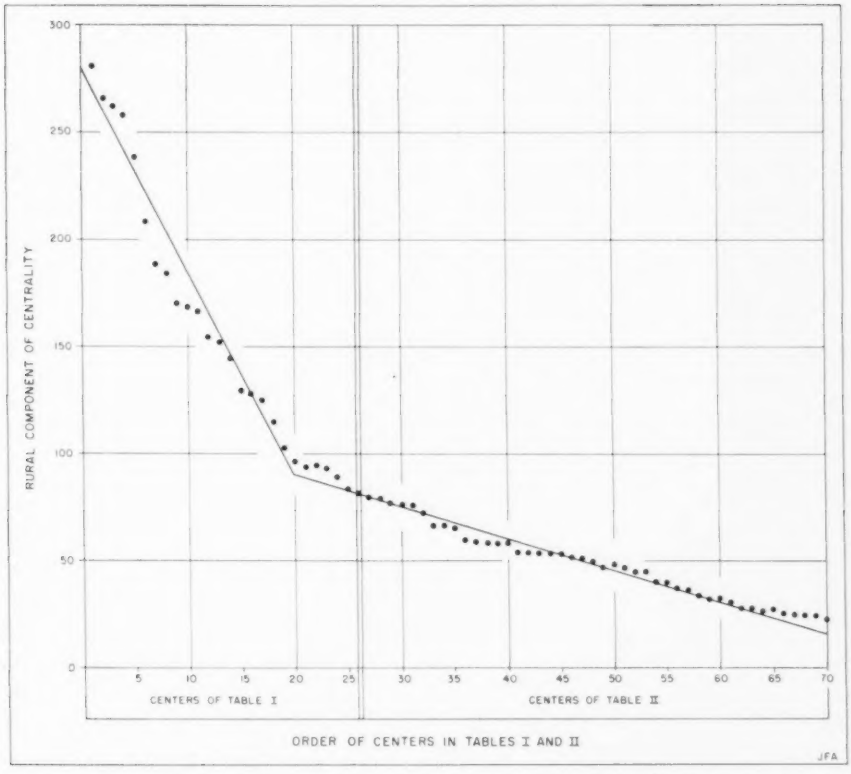


FIG. 1. Centrality of rural service centers: positions of centers in Tables I and II related to their rural components of centrality. (See bottom of Table I for scoring method.)

the few which takes notice of the fact that in certain areas, particularly those transitional to a service territory, more than one center may be visited for different services or, indeed, the same service. The aggregate of these village scores to each town gives a rough indication of its rural service importance, or its rural component of centrality.[4] A village which uses one town and no other for three out of four services is deemed to fall within its intensive area of little competition.[5] The scores of villages beyond the county boundary have been included for centers peripheral to the survey area, except that Bristol, which would undoubtedly have headed Table I, has been omitted from the statistical record since only the returns from the Somerset half of its rural territory were available.

Throughout, only villages are scored and towns falling within the service area of another town are ignored. The index of centrality is useful as a measure of the *rural component* of the total

[4] At least one village in every parish in the six counties was scored. Where a parish contained more than one separately named village each was scored independently.

[5] See H. E. Bracey: "Towns as Rural Service Centres," pp. 98–99, for fuller description of the identification and characteristics of intensive and extensive areas; or see summary by A. E. Smailes in *The Geography of Towns*, London, 1953, pp. 148–150.

service function only. If we were trying to measure the latter, i.e., general centrality, notice would have to be taken of inter-town services. The present method of analysis does not lend itself to this, however. Limitations of the method of measurement are indicated in the paper by the author which has been referred to above, but the question of weighting population can be treated briefly here. In one of the six counties, Wiltshire, all scores were weighted by village population and the centers relisted in order of the weighted score. Only one center was displaced significantly from the position occupied when unweighted scores were used. This was Swindon, which is primarily industrial but has also important rural centrality. Such distortion is bound to occur for any sizable industrial town since its overspill population, resident in adjoining rural areas, gives rise to very large semi-urban settlements, which in the United Kingdom, rank as rural parishes because they are administered by a rural district authority.

GRADING BY SERVICE RANK

In Tables I and II are listed 70 towns which scored more than 25 points. Scores range from those for important county centers like Taunton (284 pts.) to small local centers at the foot of Table II, like Street (25 pts.) or Castle Cary (26 pts.). At the outset, it must be emphasized that, because of the difference in importance of the various sets of scores, considerable differences of index values are desirable as indicating meaningful differences in status. But while discrimination may not properly be made between, say, Andover (185 pts.) and Basingstoke (171 pts.), it is clear that as service centers both places are well ahead of Petersfield (101 pts.) in the same county, i.e., Hampshire (Fig. 2).

For only one center in Table I is the score for shopping less than that for medical supplies and services or for business professions. Salisbury's shopping score is, indeed, twice that for medical supplies and services, and for many other places the difference between shopping and the professions is substantial. In Table II the reverse is generally true, although there are exceptions, notably for the seaside town of Weston-super-Mare, the tourist town of Wells, and the industrial seaport town of Southampton.[6] It may well be that these places are in process of developing rural custom, but at the present time their total scores appear too low to justify their recognition as a special class of district center.

In the United States, Hoffer[7] noted a similar trend. He found that certain towns were developing as agricultural service centers but that in professional services the shift to the larger centers was less marked. The process may have begun earlier in America where the earlier and greater use made of the motor car and truck certainly increased the rate of change. In Great Britain, the more modest post-1920 increase in mobility has, nevertheless, helped certain towns to develop as district shopping centers for Saturday and market-day excursions, but it appears not to have greatly affected the custom of the doctor, dentist, auctioneer, etc., in the small country town.

The rural component of centrality clearly offers a method of grading or ordering of centers according to service

[6] In this connection it should be noted that the largest town in the six counties, Southampton (pop. 178,326), has an index of only 60 (Table II). Southampton may, however, be suffering as a rural center from the destruction of much of its central shopping area by enemy action during the war.

[7] C. R. Hoffer: "Services in Rural Trade Centers," *Social Forces*, Vol. 10, Oct. 1931, pp. 66–71.

rank, but it fails to indicate definite grades with any degree of clarity. A single line of separation has, therefore, been drawn at the point where scores for shopping cease to exceed those for professions, i.e., between the 26th and 27th position (Tables I and II). Classifications of towns and villages by function have been made by a number of geographers and sociologists and the more important of these contributions together with their bibliographical sources have been set out by J. E.Brush[8] and need not be repeated here, except that I would draw attention to the contributions, listed therein which have been made by my friends, A. E. Smailes and F. H. W. Green, and which are particularly relevant to the subject of this article. One is reluctant to add to the already long list of classifications. The method has, however, established that all 70 places possess a rural centrality, that is, they are centers for a rural area. For the present I propose to refer to the 26 places in Table I, which have *scores for shopping higher than for professions*, as "higher district centers" and the remainder as "lower district centers." Brush has drawn attention to a second reason for a break at about this point in the table. By plotting centers in order of rank against indices of centrality (Fig. 1) a break of slope is shown between 90 and 100 points. Thus, the centers of Table I with scores of 90 (about) or more appear to have a higher degree of centrality than would be expected for their position. This is due, in the main, to their centrality for shopping rather than for other services. The breakdown of the index into separate groups of services confirms the break at the point where scores for shopping cease to exceed those for professions, i.e., at, or near, the foot of Table I.[9]

All the centers of Table I have considerable rural service importance since a score of 80 points constitutes an affiliation of at least 25 to 30 villages. Minor breaks in continuity occur in the table, and, on the map (Fig. 2), the first five and the first ten centers have been separately distinguished for this reason and in order to assist later consideration of the spatial relationship of centers of comparable rank. No very great significance should be accorded these divisions which might have been less apparent if more counties had been included in the survey.

Population and Area of Service Territories

The populations and the service areas in square miles of the centers of Table I are set out in Table III. They represent the main part only of the rural service areas of the centers; each area includes only parishes where villagers indicated that they used the center for at least three (out of four) services. Table IV, which carries the analysis a stage further, brings out the overwhelming importance, by area and total rural population served, of the first five centers—the major shopping centers—of Table I. The figures refer only to the rural parishes served by the different centers and, as already stated, do not include the populations or areas of urban districts which may fall within the service boundary.

The first ten centers in Table I all occupy inland sites and, indeed, there

[8] John E. Brush: "The Hierarchy of Central Places in Southwestern Wisconsin," *Geogr. Rev.*, Vol. 43, 1953, pp. 380–402.

[9] The late Professor A. W. Ashby, until recently Director of the Agricultural Economic Research Institute at Oxford, drew attention to a number of breaks in continuity, particularly that occurring at the seventeenth position (Table I), i.e., between Chippenham and Bridport. On the basis of minor breaks alone it would be possible to recognize a number of grades of service centers.

TABLE III

POPULATION AND EXTENT IN SQUARE MILES OF SERVICE AREAS OF THE HIGHER DISTRICT CENTERS

Center	Locally-resident urban population*	County	Rural service area	
			Extent in square miles**	Population**
1 Taunton	33,613	Som.	251	39,034
2 Dorchester	11,623	Dorset	227	16,783
3 Salisbury	32,910	Wilts.	239	23,783
4 Yeovil	23,337	Som.	180	33,797
5 Newbury	17,772	Berks.	238	34,248
6 Banbury	18,917	Oxford	117	15,740
7 Oxford	98,675	Oxford	160	51,130
8 Andover	14,661	Hants.	156	19,981
9 Bridgwater	22,221	Som.	171	23,269
10 Basingstoke	16,679	Hants.	125	21,250
11 Devizes	7,892	Wilts.	87	9,291
12 Reading	114,176	Berks.	140	45,075
13 Winchester	25,710	Hants.	155	21,320
14 Swindon	68,932	Wilts.	152	26,135
15 Blandford	3,663	Dorset	113	11,351
16 Bath	79,275	Som.	110	34,232
17 Chippenham	11,850	Wilts.	92	15,535
18 Bridport	6,273	Dorset	69	8,349
19 Frome	13,844	Som.	127	16,190
20 Witney	6,553	Oxford	81	12,847
21 Petersfield	6,616	Hants.	108	14,206
22 Sherborne	5,987	Dorset	75	7,601
23 Wimborne	4,488	Dorset	84	13,875
24 Alton	8,636	Hants.	81	12,055
25 Minehead	7,400	Som.	150	10,534
26 Trowbridge	13,844	Wilts.	63	10,796

*Urban populations set out above and in Table V are from the 1951 Census and refer to administrative areas, i.e., county boroughs, municipal boroughs, or urban districts. These are not necessarily identical with the respective built-up areas.

**This figure does not include the population or area of the center itself or of any urban district lying within the service area. These aggregates of rural parish populations are estimates, based on published 1951 Census figures for rural districts which have been checked for approximation by the clerks of the respective rural district councils.

are only two coastal or near-coastal towns in Table I, namely Minehead and Bridport. Few coastal towns appear in Table II, either, and a seaboard location is clearly a serious deterrent to the development of rural service functions for reasons which are fairly simple. The service territory of a coastal town is roughly semicircular. Furthermore, when, in the 1920's, the bus and private car began to open up the countryside many modern seaside resorts, such as those along the English Channel coast, did not possess a tradition of rural service such as had been developed and transmitted through the centuries by quite small villages which still boast of their old-time markets and periodic fairs. The "new" pleasure resorts are visited mainly for their entertainment, for cinema shows or for special shopping expeditions in which a considerable entertainment satisfaction may be expected. They are not, however, generally used for regular shopping or professional services. Business professional services, as provided by banks, auctioneers, or accountants, and everyday food and household shopping are more frequently sought in places possessing traditions of rural service—the country towns, whose hostelries and extensive, if quiet, market squares point to greater activity years ago.

In general, it can be said that entertainment scores keep in step with those for shopping with which, by index value, they are comparable. Visits by country people to the cinema are, indeed, often made in conjunction with visits for shopping, to the hairdresser, etc. Since the journey has normally to be

TABLE IV

Mean population and area in square miles of rural service territories

	Mean population	*Mean area in sq. miles*
First five higher district centers (Table I)	29,500	227
Remaining 21 higher district centers (Table I)	19,100	105
All lower district centers (Table II)	7,000	48

made by a public service bus, with its attendant inconvenience, "Let's make an outing of it" summarizes the attitude of many country visitors when making a journey to town. One must recognize, however, that special local arrangements (e.g., the enterprize of a local coach proprietor, or friendliness of a local farmer who lends his car or lorry) may make possible regular evening cinema visits to towns which are not readily accessible during the day for shopping or for other purposes. In the United Kingdom very few country wage-earners own their own automobiles and the bus service is all-important in filling gaps in local service provision.

In all counties of the survey area there are urban centers with sizable populations which give little evidence of significant rural function and set out in Table V are all towns with scores of less than 25 points. Most have some specialist functions other than rural service. The majority occur along the English Channel coast and the Solent and are either holiday resorts or contain large naval, commercial, or industrial establishments. Some of the few remaining are, primarily, inland industrial towns, e.g., Melksham and Westbury in Wiltshire. Others are overshadowed by larger country towns which through a variety of factors have succeeded in building up considerable rural service importance. Of these the following can be cited: Woodstock (near Oxford), Wilton (near Salisbury), and Bradford-on-Avon (near Trowbridge).

Spatial Distribution of Service Centers

The spatial distribution of the centers of Table I constitutes a fairly open, evenly-spaced network (Fig. 2). The first five towns are an average road distance apart of *26 miles;* the next five are *18 miles*, and the remaining 16 are *12 miles*. The mean distance apart of all higher district centers is *21 miles*, a figure almost identical with that given by Brush for his 19 "towns" in Wisconsin.[10] The mean distance of all lower district centers from centers of comparable or higher status is *8 miles;* Brush gives 9.9 miles as the relevant figure for his 73 "villages."[11]

The territories shown on the map comprise all rural settlements which use the centers of Tables I and II for at least three out of the four groups of services. The areas themselves, therefore, constitute areas of circulation of country dwellers for the satisfaction of a majority of their ordinary needs. The circulation areas of the higher district centers, are shaded, whereas the territories of lower district centers are given in outline only. The few blank areas are occasioned by a number of factors. The majority are relatively sparsely-populated districts served by village centers of an order too low to appear in Table II. For instance, the gap in North Wiltshire, between Swindon and Malmesbury, is served by the ancient market town of Cricklade which

[10] Brush, *op. cit.*, p. 393.
[11] *Ibid.*, p. 393.

TABLE V

TOWNS IN THE SURVEY AREA WHERE RURAL SERVICE IS OF MINOR IMPORTANCE

(i.e., where the rural component of centrality was less than 25 points)

Town	*Urban population**	*Index*	*Notes on site and specialized function(s)*
Berkshire			
Wokingham	3,385	19	near Reading—competition
Hampshire			
Havant	44,453	22	coastal—industrial
Eastleigh	30,557	18	industrial
Aldershot	36,184	9	army barracks
Bournemouth	144,726	7	coastal—holiday resort
Portsmouth	233,464	17	coastal—Royal Navy barracks
Christchurch	20,506	7	coastal—holiday resort
Fleet	9,018	less than 5	army barracks
Gosport	58,246	less than 5	coastal—Royal Navy barracks
Dorsetshire			
Poole	82,956	25**	coastal—port and holiday resort
Portland	11,324	less than 5	coastal—Royal Navy barracks
Lyme Regis	3,191	11	coastal—holiday resort
Swanage	6,853	19	coastal—holiday resort
Oxfordshire			
Woodstock	1,713	6	near Oxford—competition
Somersetshire			
Clevedon	9,467	19	coastal—holiday and resort
Keynsham	4,454	16	industrial—near Bristol and Bath
Portishead	8,277	12	coastal—port and industrial—holiday resort
Wiltshire			
Bradford-on-Avon	5,627	23	industrial—near Trowbridge—competition
Melksham	6,727	19	industrial
Westbury	5,264	11	industrial
Wilton	2,857	11	near Salisbury—competition

*See footnote to Table III with reference to origin of figures.
**Figures are to the nearest whole number and the actual figure for Poole was 24.8.

continues to serve an area roughly coincident with its medieval market areas.[12] In the area behind the major ports of Southampton and Portsmouth, however, country people appear to use any and every urban district indiscriminately. This urban competition explains Southampton's relatively low score and the absence from the tables of towns like Portsmouth and Havant.

A number of further features are brought out by the map:

(1) The distribution of central places is far from regular. Berkshire has two higher centers; Oxfordshire has three; Wiltshire, Hampshire, and Dorset each have five and Somerset six higher centers.

(2) Each county has at least one "major" service center if the first ten towns of Table I are so described.

(3) The criterion (use of a center for at least three services out of four) gives areas which together cover almost the whole of the survey area. The only two noteworthy blank spaces shown on the map represent, firstly, in north Somerset, the sphere of influence of Bristol which is not shown, and, in southwest Hampshire, the thinly-populated area of the New Forest.

(4) There is no extensive overlapping but the frequent, slight overlapping of many areas serves to remind us that

[12] Part of West Somerset is served by Dulverton, a village center, and part by Tiverton, which lies in Devon outside the survey area.

service areas are seldom mutually exclusive. Service boundaries of important centers are only clear cut when they coincide with a physical obstacle to free movement such as a range of hills or an unbridged river. This is illustrated by the Brendon ridge which constitutes the western half of the boundary between Bridgwater and Taunton (Fig. 2). Farther east, in lowland country, the same two centers are separated by a broad overlap zone.

(5) It is noticeable that certain areas are served almost exclusively by lower district centers. For example, whereas, in north Hampshire, there are six higher centers, the south of the county is served by six lower centers. Again, there is a wedge of lower centers across central Somerset which separates higher centers to south and west from those to the north and east, the latter extending into north Wiltshire. This special distribution is referred to again later in the paper.

(6) The spacing of centers in the areas served mainly by higher centers is of the order of 15–20 miles. In the areas served mainly by lower centers the pattern is closer and centers are more commonly 5 to 10 miles apart.

The towns of Table I serve between them a little over half the total area of the six counties; most of the remaining half is served by the 44 lower district centers of Table II. This is significant. It is generally assumed that since 1920 the whole of the countryside has been gradually drawn into the net of a few big shopping centers and this may be so for very special needs, obtained on very occasional visits. But the enquiry shows that approximately one-half of the total area of the six counties is still served for a majority of ordinary needs by a relatively large number of smaller country towns, or by towns which possess specializations other than rural service; for example, the industrial towns, the seaside towns, and so on provide some services for country people. The centers of Table II are of an order lower than those of Table I, but they are clearly independent centers of service since each has its own intensive area, i.e., a territory where it is supreme as a service center and is not subject to significant competition. This is not to say that larger centers are not used regularly or at all, but simply that frequent visits are not made to them for the satisfaction of ordinary needs.

Modification of the Traditional Pattern of Service Centers

Present-day country towns in the United Kingdom were generally established as local farming communities, some 500 years before the Norman Conquest. The highway had little, and the railroad no, influence on their original siting. When the nineteenth century industrial revolution began, there was, therefore, spread over much of lowland England, a close network of small market towns, developed from the earliest agricultural centers. These possessed also craftsmen skilled in attending to the needs of a mainly agricultural population. Towns were generally separated from each other by distances of five miles or so. In certain parts of the United Kingdom these conditions continued into the twentieth century; East Anglia probably offers the clearest example of this as Dickinson[13] has shown. Elsewhere, the whole service pattern was completely changed during the nineteenth century by the development of local mineral wealth or local manufacturing specialization. In Yorkshire, south Lancashire, and the midlands of

[13] R. E. Dickinson: "The Distribution and Function of the Smaller Urban Settlements of East Anglia," *Geography*, Vol. 7, 1932, pp. 19–31, and *City, Region and Regionalism*, London, 1947, p. 80 et seq.

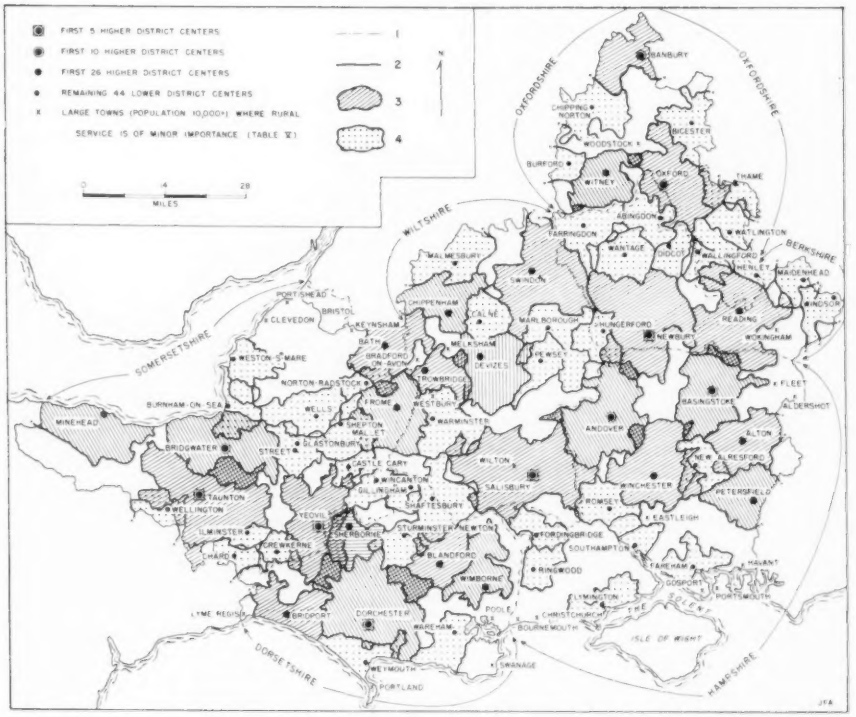


FIG. 2. Rural service centers and their areas of circulation for six counties in southern England. Numbers refer as follows: 1, county boundary; 2, boundary of rural service area (irregular shapes due to use of parish boundaries); 3, area of higher district center (Table I) (direction of shading carries no significance); 4, area of lower district center (Table II). Unshaded areas are served mainly by centers of an order too low to qualify as lower district center. A number of these are sparsely populated. Base: Ordnance Survey of England and Wales, sheets 7, 8, 10, 11, and 12.

England, only remnants remain of the original rural pattern. Over the greater part of the United Kingdom, however, and particularly throughout the survey area, a great number of country towns acquired specialist functions, such as manufacturing industry, which enabled them to support larger populations. In many instances, the early service functions were not eclipsed and the centers grew to be more important district centers because of the services necessarily provided for their larger local urban populations. There were many medieval market towns, on the other hand, which declined so that they are now indistinguishable from agricultural villages. This was a gradual process, however, and there was no radical alteration in the spacing of service centers until rural bus services and improved communication generally made possible and reasonable longer journeys and larger territories.

Since 1920 there has been drastic modification of the distribution pattern of service centers. In southern England, for instance, regional markets have grown up at Dorchester, Salisbury, and Reading. Taunton, Winchester, and Dorchester are country towns which have gained importance from the increase in local government functions associated with county-town administration. Substantial increments of industry have been acquired by Yeovil,

Oxford, and Bridgwater. Others have gained from local and national traffic on road and rail. Thus Reading, Swindon, Chippenham, and Bath are on the main railway line from London to Bristol, and Basingstoke, Andover, Salisbury, and Yeovil are on the main highway from London to Exeter and the southwest of England.[14]

Maintenance of the Medieval Pattern of Service Centers

The modern settlement pattern thus results from an interplay of many factors and functions, historical, economic, and social, and an overlay of many forms. Nevertheless, it has been possible to draw attention to certain broad distributions and to one of these we would return. It has been noted that there are tracts of country served by a small number of widely-spaced, higher district centers, whereas other tracts are served by a larger number of more closely-spaced, lower district centers.

In that part of Somerset served by the three neighboring lower district centers of Chard, Ilminster, and Crewkerne inter-town accessibility by public transport is reasonably good, but the whole area is so sparsely populated and so remote from a really important center that individual villages are relatively inaccessible. Under these conditions country towns appear able to retain some of the importance as local centers they enjoyed in the pre-bus age. The maintenance of the medieval spacing of market towns—four to six miles—into the twentieth century appears to have made it difficult for a single center to attain higher status. The three small towns, Chard (pop. 5218), Ilminster (pop. 2610) and Crowkerne (pop. 3838), have rural components of centrality which differ by a few points only (Table II). Each suffers competition from Taunton and Yeovil for certain services, e.g., for special shopping or entertainment, wholesale supplies, certain specialist professional services, and so on. But, equally important, each town is in competition with its near neighbor for ordinary everyday requirements.[15] The three towns have stood side by side for centuries, first as agricultural centers and then as partners and rivals in the widespread manufacture of woollen cloth which, during the Middle Ages, brought fame to the West of England. There is a feeling of rivalry which runs right through the life of the towns at all social and economic levels. Had there been one town only in this locality it would undoubtedly by now have acquired the status of a higher district center. As it is, the resources of the three centers are so dispersed that neither town can give first-class service in a sufficient number of branches, and more and more custom finds its way to the larger centers of Taunton and Yeovil.

One might have predicted in the light of pre-war conditions that this trend would continue indefinitely. Since the war, however, and partly due to wartime dispersal of industry and population, there has been an increase in industrial activity in the region, particularly at Chard and Ilminster, which has led to an influx of population and a consequent increase in demand for services within the towns themselves. The ultimate result of this industrial infusion is in doubt. The three small towns may fight the battle out until one becomes dominant as rural service center. Alternatively, the custom may continue to be spread over the three centers or, finally, the decline may be resumed and the big centers may eventually come to dominate the whole scene.

This situation is not unusual and can

[14] Knowledge of the communications network is clearly necessary to recognize these lines from the map.

[15] Most villagers indicated that they visited all three towns regularly for their services.

be paralleled elsewhere in the survey area. Almost identical conditions obtain in the wedge of lower centers across central Somerset, but here Wells appears to be asserting itself and may well become the dominant center if the present trend continues. This can only take place at the expense of neighboring centers of Shepton Mallet, Glastonbury, and so on. In east Wiltshire and west Berkshire, three lower centers, Pewsey, Marlborough, and Hungerford, appears each to be fighting a losing battle with nearby higher centers. Similar clusters of lower centers can be identified in north Berkshire, central Oxfordshire and north Dorset.

THE FUTURE

During the centuries there has been a continual ebb and flow in movement of people, goods and services for the satisfaction of changing, everyday needs. With the creation of agricultural surpluses, the growth of industrial skills, and the development of improved means of communication, the point of exchange and service has, in the United Kingdom, swung from the medieval manor to the regional fair, back to the local market stall, then to the country-town shop and lastly, since 1920, towards regional shopping and servicing at the expense of many small towns which had contrived to retain their rural custom throughout the nineteenth century. There may yet be another swing back to the smaller local town as customs develop and habits change.[16] Every new service, or duplication of an old service, set up in, or withdrawn from, a service center ultimately affects its centrality. The scene has never been static and, at the present time, is characterized by very considerable fluidity. While major changes, mostly related to decisive stages in the development of transport and communication, have taken place from time to time, small changes are taking place all the time in response to the provision of new services and for the satisfaction of new needs.

Christaller did the cause of urban geography a disservice by claiming a wider application for his theory of location than was justified. It is clear that the central-place theory throws little light on the distribution of settlements in close-packed, industrial areas, but as Edward L. Ullman has written, "Some form of the central-place theory should provide the most realistic key to the distribution of settlements where there is no marked concentration—in agricultural areas, where explanation has been most difficult in the past.[17] To this I would add that a satisfactory estimate of total centrality has first to be devised and, from preliminary analyses carried out with census of occupation figures, it seems likely that this will eventually be done by assessment of the number of people engaged in providing certain services in excess of the number needed to serve the locally-resident population. When such estimations of centrality become possible on a national scale the measurement of the rural component of centrality described in this paper should provide a means of making useful local checks on assessments based on less-laborious field work.[18]

[16] One is reminded that in the 'twenties of this century radio agencies were only to be found in the biggest towns, but it was not long before they reached every small town and many villages. Similarly, multiple stores were, at first, only found in the biggest cities but have now spread to many country towns.

[17] Edward L. Ullman: "A Theory of Location of Cities," *Amer. Journ. of Soc.*, Vol. 46, 1941, pp. 853–864.

[18] Since receipt of this paper the following related articles have appeared in print: J. B. Fleming: "An Analysis of Shops and Service Trades in Scottish Towns," *Scottish Geogr. Mag.*, Vol. 70, 1954, pp. 97–106; Harold Carter: "Urban Grades and Spheres of Influence in South West Wales," *Scottish Geogr. Mag.*, Vol. 71, 1955, pp. 43–58; John E. Brush and Howard E. Bracey, "Rural Service Centers in Southwestern Wisconsin and Southern England," *Geogr. Rev.*, Vol. 45, 1955, pp. 559–569.

RECENT EXPANSIONS IN THE SOUTHERN PULP-PAPER INDUSTRIES

Merle Prunty, Jr.

Professor Prunty, head of the Department of Geography and Geology, University of Georgia, is well known for his articles dealing with various aspects of the geography of the South.

THE increasing importance of southeastern sources in United States pulp and paper production has been evident during the past decade. A 1952 estimate suggested that at least 55 per cent (by volume) of the national pulp-paper output was produced in the South.[1] Recent publication of two Southeastern Forest Experiment Station bulletins confirms the dominance of the South in pulp-paper output; however, the proportionate buildup of southern production has been greater than was estimated in 1952.

In 1944, the South was responsible for about 44 per cent of domestic pulpwood output. By 1952, total southern production was 14,564,900 cords, an increase of 17.1 per cent over 1950, and accounted for 58 per cent of all United States pulpwood cut. Nineteen hundred fifty-three production increased to 16,127,000 cords and 61 per cent of domestic production.[2] By far the leading production area, and the most rapidly growing one, is in South Georgia–North Florida (Fig. 1). Georgia alone now produces 18 per cent of southern and 11 per cent of national pulpwood output (approximately 2,900,000 cords); Georgia, Mississippi, Alabama, and Florida together account for slightly more than half the South's present cut. Pulpwood production has increased steadily in all southern states except Oklahoma and Tennessee since 1950.

These recent production increments are reflections of increased regional pulpmill capacity, as well as dividends from improved production and management practices in the forests themselves. At the beginning of 1953, there were 63 pulpmills in the South, four additional mills outside the area were drawing on its pulpwood cut, and six new southern mills with a combined daily plant capacity of 2375 tons (approximately 9 per cent of 1952 regional total capacity) were under construction (Fig. 2). Four of the six new plants began production by October, 1954 (Rome Kraft, Rome, Georgia; Bowaters Corporation, Calhoun, Tennessee; National Container Corporation, Valdosta, Georgia; Rayonier, Inc., Jesup, Georgia). The others (Buckeye Cellulose, Perry, Florida; East Texas Pulp and Paper, Evadale, Texas) are expected to reach production early in 1955.

Demand for pine seedlings for restocking has exceeded supply throughout the South since 1945, and seedling

[1] Merle Prunty, Jr.: "Land Occupance in the Southeast: Landmarks and Forecast," *Geogr. Rev.*, Vol. 42, 1952, pp. 439–461.

[2] "1952 Pulpwood Production in the South," *Forest Survey Release 72*, May, 1953, pp. 1–3; "1953 Pulpwood Production in the South," *Forest Survey Release 43*, July, 1954, pp. 1–4; Southeastern Forest Experiment Station, Asheville, N. C.

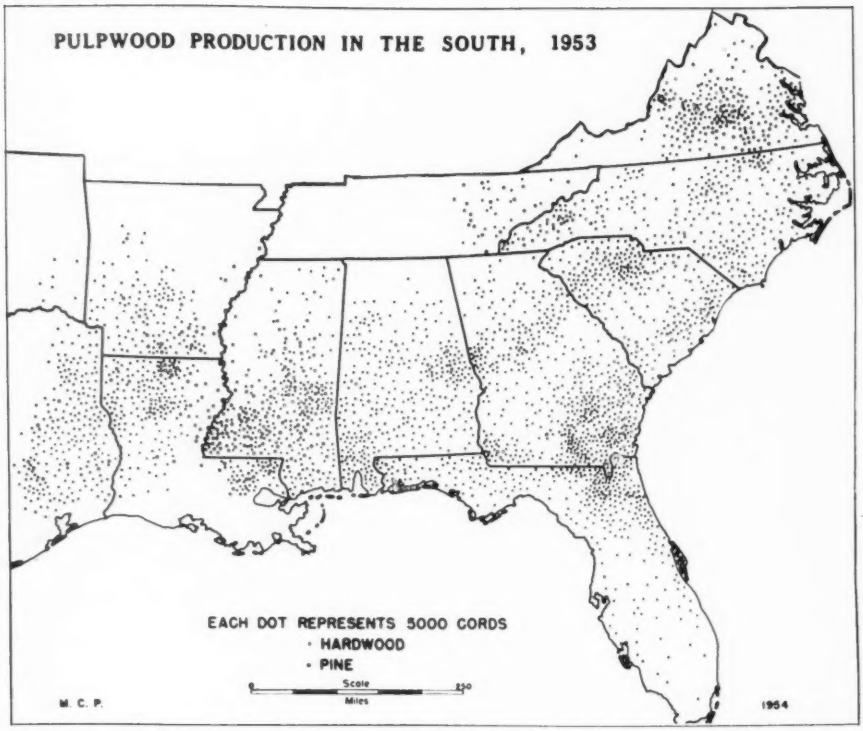


FIG. 1.

output has increased geometrically, roughly, since that date. Stands subjected to postwar restocking will begin to reach pulp production size late in this decade. When coupled with currently expanding plant capacity, the extensive restocking of the past decade can only presage further increases in southern pulpwood output, quite probably increasing the South's proportion of national production to more than 70 per cent.

PULPMILL LOCATIONS AND SUPPLY SOURCES

Until very recently, sites selected for pulpmills have been adjacent to or in the midst of areas with unusually large woodland acreages. The clusters of mills in southeast Georgia–northeast Florida (11 mills) and about Mobile Bay (8 mills) are illustrations. Customarily these mills have obtained ownership (or control through long-term leases) of sufficient nearby woodland to insure annual pulpwood production equivalent to approximately one-third of mill requirements. In recent years, mill managements have avoided obtaining control of a greater proportion of their woodland supply-area in order to support local, small-farm pulpwood production, and to avoid the criticisms which are inevitable when one corporation owns most of the land in several adjoining counties. Despite efforts to avoid undue local concentrations of ownership, some have occurred and

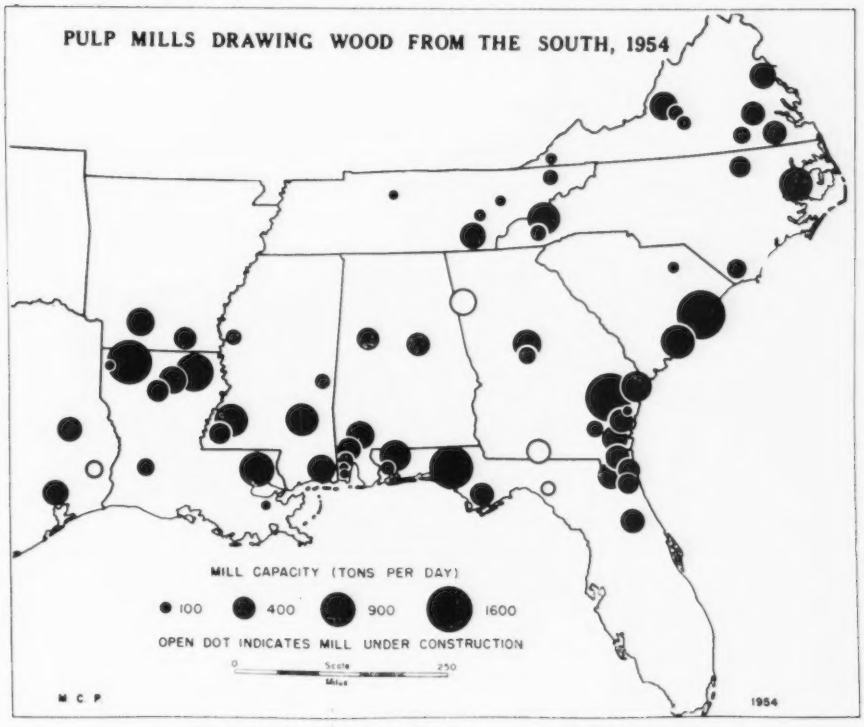


FIG. 2.

criticism has resulted. Currently, several companies are obtaining control of forest stands as much as 100 miles from millsite because in these peripheral locales their holdings are proportionately small; peripheral ownership increments are preferred in part because public criticism is virtually nil. It should be remembered in this connection that about 86 per cent of southern woodland is privately owned and includes some 123,750,000 acres with an average holding size of 75 acres per owner.[3] In other words, small farmers are key sources of woodland products in the South and are sensitive to the manner in which markets for woodstuffs conduct themselves.

Union Bag and Paper Corporation at Savannah, Georgia, is representative in both location and in pulpwood-source management of the older mills in the region. This company's plant is the world's largest manufacturer of kraft containers and is generally referred to as the largest pulp-and-paper production unit at one site. The plant's daily output consists of 40 million kraft paper bags of many types, 750,000 cardboard cartons and boxes, and lesser quantities of specialized kraft papers.[4] Daily capacity for kraft papers of all types amounts to 1900 tons. The plant site occupies most of an old plantation on

[3] C. E. Behre and S. B. Hutchison: "Gaging the Timber Resources of the United States," *A Reappraisal of the Forest Situation: Report No. 1*, U. S. Department of Agriculture, Forest Service, 1947, pp. 3–22.

[4] Georgia Department of Commerce: Newsletter, August 25, 1953, pp. 3–7.

the tide-water section of the Savannah River. Daily pulpwood consumption averages about 2800 cords (160 rail carloads) which is delivered millsite by truck, barge, and train. Slightly more than 900,000 woodland acres are controlled by the company, most of them within a radius of 70 miles of Savannah.[5] Georgia and Florida counties within a 120-mile radius south-southwest of this plant average more than 90 per cent of total area in woodland. With 11 plants operating in the area, its high proportion of woodland is readily understandable. Significantly, the percentage of area in woodland is greater than 20 years ago.

The new Rome, Georgia, plant of the Mead Corporation illustrates a different concept in pulpmill location. This plant, just now achieving capacity operation, is situated near the center of a triangle whose angles are represented by large pulp-paper mills at Childersburg, Alabama; Macon, Georgia; and Calhoun, Tennessee (Fig. 2). The three mills together have a daily capacity of about 1700 tons of finished products. The Calhoun, Tennessee, plant began production in October, 1954; prior to that date pulpwood moved regularly from the Rome area to both the Childersburg and Macon plants. During 1953, Floyd County (in which Rome, Georgia, is situated), plus five surrounding counties, produced about 55,000 cords of pine pulpwood, or enough to supply the new Rome plant for only 81 days of capacity production if no pulpwood shipments proceeded to the other three mills. Officials of the new plant have agreed, privately, that adjacent woodland is insufficient to sustain long-range consumption requirements, and that competition from the three nearby plants will reduce the existing supply somewhat. However, based upon woodlands regeneration which other mills have stimulated after original woods supplies have been consumed, these officials expect upgrading, restocking, and reforestation to create pulpwood in excess of mill needs before the existing adjacent woodlands are exhausted. In short, the expectation is that the market stimulus provided by the mill will create the volume of pulpwood necessary for sustained pulping. The resultant increments in woodland acreage, altering the texture of land use and occupance throughout the pulp market area of the mill, will be, geographically, most significant.

The new Bowaters Southern Paper Corporation plant (wholly British-owned) at Calhoun, Tennessee, has a newsprint capacity of 600 tons daily and is the only southern newsprint source wholly owned by a manufacturer, with no newspapers involved (Fig. 2).[6] About 100 southern newspapers have contracted for the output of Calhoun plant for the next 15 years. Southern pine deteriorates quickly when stored in the open, and most mills store at least two weeks reserve supply of pulpwood at all times. Calling upon its Canadian experience, the Bowaters management constructed a millpond at millsite which is capable of storing 30,000 cords of pulpwood. This is the first instance in which a pond has been used by a southern mill. Underwater storage of southern pines retards their deterioration, and they pulp more readily thereafter.

Its location in southeastern Tennessee indicates that the Calhoun plant will call upon woodland throughout the eastern TVA area to an unprecedented extent. TVA's concern with woodland to protect and regulate its upper water-

[5] *Loc. cit.*

[6] *Fortune*, Volume 50, No. 4, October, 1954, p. 101.

sheds is well known. For many years TVA has encouraged both woodland and permanent pasture expansions in order to transfer as much as possible of the late winter-spring precipitation maximum of the area into reserve summer water stocks—TVA reservoir storage is least during late summer. The effects of the Calhoun plant upon TVA summer water stocks remain to be seen. If the history of other mills using southern pine is repeated, the market stimulus which the mill affords may expand the woodland acreage and result in upgrading the quality of woodland in the TVA area. On the other hand, a significant minority of the pulpwood supply adjacent to the Calhoun site consists of hardwoods whose regrowth rates do not approximate those of southern pine. There is, therefore, the prospect of a high proportion of woodland in thin stands or small growth for extended periods, and the prospect of *larger areas* so affected than would be the case in a forest area devoted exclusively to southern pines. Should this prospect eventuate, the effects upon TVA's summer water stocks could be serious.

THE HARDWOOD PULP PROSPECT

In recent years hardwoods have become increasingly important in the southern pulp-paper industry. Pulp hardwood cut in 1946 (including dead chestnut) amounted to 1,210,300 cords, but by 1953 had increased to 1,979,400 cords. As dead chestnut has been cut out, its significance as a wood source has become minor. Although the amounts of pine pulpwood cut have increased steadily, the proportionate increase in hardwood pulpwood has been even greater; today hardwoods account for 12 per cent of all southern pulpwood.[7] Plants such as that at Calhoun, Tennessee, which are able to handle hardwoods by "semi-chemical" processes (originally developed in the Forest Products Laboratory at Madison, Wisconsin), naturally increase markets for hardwood pulp.[8] Hardwood semi-chemical pulps are appreciably stronger than are sulphite pulps made from the same wood and approach strengths for kraft pulps. These pulps tend to produce hard, brittle, stiff sheets and thus are well suited to corrugated boxes and cartons. Presently about 500,000 tons are used annually for boxing alone.[9] These properties coincide with a paper industry trend toward proportionately more and more paperboard, box, and carton production; since 1929 the proportion of American papermill output devoted to paperboard boxes and containers has increased from 39.9 to 50.1 per cent (1952).[10] Sproull points out several advantages from use of hardwood pulp via the semi-chemical process: hardwoods yield more than pines; the yield by semi-chemical process is 10–15 per cent greater than from the kraft or sulphite process in any event; hardwoods weigh more per cord—hence more wood can be processed per mill digester; costs per ton of finished pulp are no higher than by sulphite processes; and, finally, the semi-chemical process provides a market for heretofore less desirable and even undesirable woods.

Presently, the largest southern hardwood-pulpwood production areas consist of southern and southwestern Mississippi (producing more than half the regional total); west central Virginia including segments of Piedmont, Ridge and Valley, and the Alleghenies cen-

[7] *Forest Survey Release 43, op. cit.*

[8] *Paper Trade*, J, 129; No. 2, pp. 84–99.

[9] R. C. Sproull: "Semi-Chemical Pulping," *Bulletin Ga. Acad. Sci.*, No. 3, June, 1954, pp. 58–64.

[10] J. E. Gates: "The General Picture," *Fibre Containers and Paperboard Mills*, August, 1953, pp. 70–92.

tered about Buckingham, Amherst, and Allegheny counties; western North Carolina; and the Cumberland-Highland Rim counties of northern Tennessee (Fig. 1). Scattered production also occurs throughout the coastal plains from northern North Carolina to southwest Georgia—largely as consequence of removal of hardwood understories in regrowth pine forest. It is well known that hardwood regrowth tends to crowd out young pines throughout the Piedmont, northern Alabama, Mississippi, and other non-lower coastal plains locales. Pines must be protected by hardwoods removals during early regrowth stages. Controlled burning during springtime frequently is recommended by foresters to eliminate the hardwood understory if it is young, or culling is recommended if hardwoods threaten to crowd the crowns of young pines. To date there has been no market of consequence for these hardwood removals; the semi-chemical process offers the prospect of a substantial market for "culls," and for hardwoods in the Appalachians, Ozarks, Mississippi Valley, and Highland Rim areas generally. It is significant to note that regrowth rates of Mississippi Valley cottonwoods generally equal and occasionally exceed rates for pines in southeastern Georgia; it is possible that poorer quality alluvial soils adjoining the Mississippi may become a major pulpwood source. An extensive cooperative research program on utilization and management of southern hardwoods was initiated in the summer of 1954 by the United States Forest Service and the several southern states, under a special appropriation enacted for that purpose during the last session of Congress.

THE OUTLOOK

Most current American economic geography texts incorrectly emphasize pine chipping-and-cupping as the source of turpentine and naval stores and ignore the most important process in turpentine recovery. As late as 1930 about six-sevenths of all naval stores were produced from chipped pine facings. However, of the 708,000 barrels of turpentine and 2,137,000 drums of rosin produced from the southern pine forest in 1951, about 65 per cent was recovered as a *by-product of pulp-paper manufacture*. The steady climb from year to year in volume of pine that is pulped indicates that the percentage of turpentine recovered as a paper by-product will become even greater.

In 1952 this writer predicted increasing competition late in this decade between forests and improved pastures for occupance of many southern areas.[11] Since then the "aggressor" has been the forest, and expansion of pastures has lagged. The nationwide "break" in cattle prices during the summer of 1952 was followed by extensive droughts in the South in 1952, 1953, and 1954. Thus two important stimuli to southern livestock expansions—favorable prices and abundant grass—have been severely curtailed. If pasture expansions are to make significant additional inroads on woodland acreages they will have to do so during the last half of the decade.

Professional foresters consider a majority of the southern pine forest capable of producing a cord of wood per acre per year under proper management. However, current production averages only slightly more than a quarter of a cord. Pulpwood increments, which might ultimately amount to 50 per cent of present production, or more, will not necessarily depend upon forest acreage expansions for the South as a whole, in spite of the fact that some areas now

[11] Merle Prunty, Jr., *op. cit.*

contain small proportions in woodland. Instead, there is room for abundant pulpwood expansion within the existing forest acreage. There is, too, an ever-increasing American market for paper products. Additional new mills in the Southeast are inevitable. Judging from the record of the postwar years, greater per-acre productivity from the southern forests is most likely to occur in response to the markets created by construction of additional pulp-paper mills. Thus it is easy to visualize the southern forests as the source-area for three-fourths of the national pulpwood cut by the mid-1960's.

JAPANESE LAND DEVELOPMENT IN KOJIMA BAY*

John D. Eyre

Dr. Eyre is an assistant professor in the Department of Geography, University of Washington.

PADDY reclamation in Kojima Bay illustrates the importance of past and present reclamation of coastal swamps and shallow waters to secure additional level land in Japan. During the past three centuries the Japanese have been reclaiming the bay fringes as the sole remaining means of adding to the productive surface of the Okayama Plain, an important lowland in the Inland Sea region of western Japan. Consequently, as a case study the bay project gives a good perspective on the long struggles of the inhabitants of the plain to reshape and reorganize the lowland and associated water bodies into a pattern better adapted to their social needs.

Since 1573 Kojima Bay reclamation has added about 18,000 acres of new land, about three-fourths of it paddy, to the Okayama Plain, which is one of the most densely populated and economically advanced Japanese lowlands. Final reclamation units scheduled for completion in 1956 will add 6000 more acres. Although small by American standards, the bay project is the largest reclamation work currently under way in Japan. Crops raised on the new lands will bolster the local agricultural economy and will provide food surpluses for wider regional distribution. Also, a small reclaimed area has been set aside as an industrial zone to accommodate anticipated industrial growth in Okayama City.

Analysis of past and present reclamation in Kojima Bay is directed toward an understanding of the general characteristics of Japanese land development to the extent that they are revealed by a single case study. What forces have stimulated reclamation at various past periods? By what means has reclamation been carried out? What have been the principal physical and cultural barriers to reclamation and what degree of success has been realized in their solution? What is the general character of the economic pattern superimposed upon reclaimed lands? Answers to these and related questions also have specific local application in relating bay reclamation to the historical development of the Okayama Plain and its leading centers.

Physical Character of the Bay

Kojima Bay is a shallow body of water sandwiched between the southern borders of the Okayama Plain and mountainous Kojima Peninsula, linked by a narrow channel at its eastern end with the Inland Sea. Bay and plain have a central location on the southern coast of the Chugoku Peninsula, midway between the industrial-agricultural

*Data for this article were collected through library and field research in Okayama, Japan, 1950–51, with funds provided by the Social Science Research Council. Additional field work in Okayama was done in September 1953 when the author was in Japan on a Ford Foundation fellowship. Views expressed are solely those of the author and not of the supporting foundations. The author wishes to thank the University of Michigan Center for Japanese Studies for the lodging and research facilities provided at its Okayama field station.

complexes of northern Kyushu and the Kinki region (Osaka-Kobe-Kyoto). Rather than distinctive physical units requiring separate treatment the bay and plain long have been linked in an inseparable association. Most of the plain now occupies an area once covered by bay waters, and both have been important elements in the evolution of local economic patterns.

The Okayama Plain is small and irregular in shape, extending about 25 miles from east to west and 15 miles from south to north in the midst of encircling highlands. On three sides granitic hills of less than 800 feet elevation set its interior margins; along its southern border the eroded heights of the shoe-shaped Kojima Peninsula deny the plain sea frontage and thus set the southern border of Kojima Bay.

Isolated hills scattered across the plain are remnants of early faulting on a generous scale, and at one time stood as islands with intervening fault basins filled with sea water. As late as the twelfth century Kojima Peninsula was still an offshore island. In fact, a small-scale naval battle was fought in the narrow strait separating it from the plain at its western tip. Since then river-borne sediments have steadily advanced the coastline seaward, until the western end of the peninsula has been linked with the mainland. Only the steadily shrinking waters of Kojima Bay now remain of the broad sheet of water that formerly separated Kojima Bay from the sea edge of the plain.

The bay has been filled in over a long period by sediments transported by three large and several smaller rivers moving seaward from the mountainous interior. The Takahashi River, which empties into the Inland Sea west of Kojima Peninsula, has built up the western part of the plain. Two other main rivers, the central Asahi and the western Yoshii, both bring heavy loads of sand and gravel to the bay. The Yoshii River, in particular, is an active erosive agent and furnishes sediments that are either swept out to sea or into the inner reaches of the bay by tides and currents. The rivers pose such a serious flood menace that their elevated stream beds are fixed and enclosed by high protective dikes as they pass through the productive plain. Fifty major floods and hundreds of lesser local ones have damaged the lowlands during the past 300 years.

The deposition of sediments has not been equal around the bay perimeter. The area west of the Asahi River was especially slow to build up because of the scouring action of the sea currents entering the bay with the incoming tide. Finally, this area and a zone between the Asahi and Yoshii Rivers were reclaimed late in the seventeenth century, fixing the coastline at that point as it appears today. Following this engineering development large quantities of Yoshii sediments were swept into the inner bay, thus providing the base for a long series of reclamation projects, of which the present units are a concluding phase. The scouring action of currents has minimized deposition of sediments along Kojima Peninsula, so that it remains the only section of the bay where even minor lowlands have failed to emerge. The speed of Kojima Bay deposition and accompanying reclamation works has pushed the plain seaward at a pace equalled in few places in Japan. During a 300-year period prior to 1912 an average of one kilometer of land was added to the coastline every 42 years.

LAND DEVELOPMENT PERIODS

The bay has figured in the plain's development during three historical periods: (1) from earliest times to

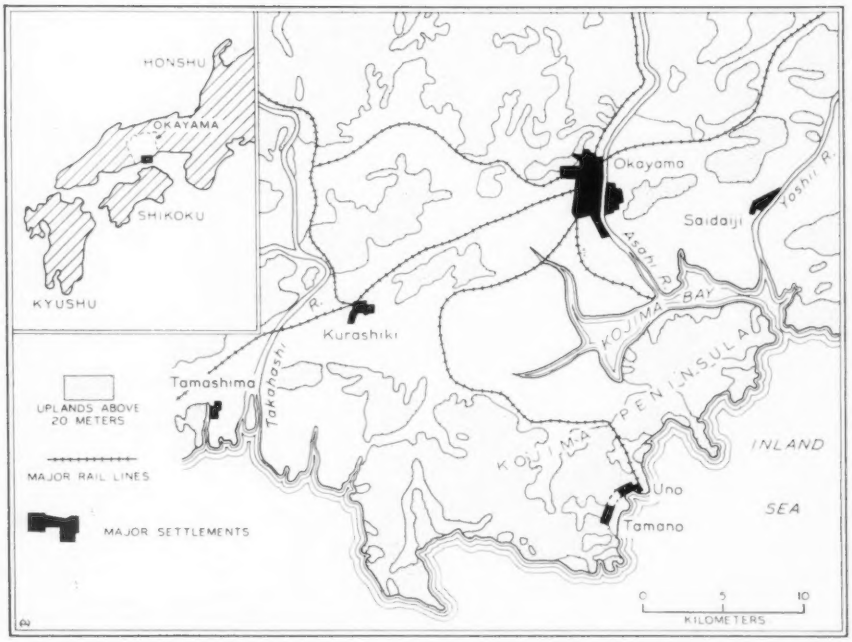


FIG. 1. The Okayama Plain, showing the position of Kojima Bay. The location of the plain and bay in Okayama Prefecture and western Japan is shown in the insert.

1573; (2) from 1573 until the end of the feudal period in 1867; and (3) from 1868 to the present. During the first period the attention of the early settlers was directed toward reclaiming what are now the inner parts of the growing plain and building simple dikes and other river control works. Kojima Bay was little used except for transportation and fishing. After 1573, however, ambitious bay reclamation works were undertaken, indicating that by that time the best parts of the plain were already in paddy and that enough sedimentation had taken place to make reclamation possible. This same period is important for the emergence of Okayama City as an economic and political control center influencing accelerated land development. During the modern period the reclamation of remaining shallow bay fringes has been pushed to near completion, with remaining bay waters to be incorporated into a fresh water lake. Briefly summarized, the bay has been the most important source of new agricultural land for the Okayama Plain since 1573.

The three development periods encompass 20 centuries and a variety of different economic and political systems. However, several themes are common to all three periods.

First, land reclamation has never been a continuous, systematically plotted process in keeping with a long-range plan for resource development. Rather it has been a sporadic nibbling which in the sum total of centuries of effort adds up to an impressive human accomplishment. The efficiency with which lands have been reclaimed and subsequently managed has been short of ideal because of small size,

fragmented irrigation arrangements, and other physical deterrents. Bay reclamation has also been subject to similar vagaries of economic and political history that have determined the tenor and pace of agricultural developments elsewhere in Japan. At times reclaimed lands were abandoned because of natural calamity and warfare, only to be reclaimed again in response to population pressures and economic policies.

Second, the planning, financing, and management of reclamation have been handled by the government or by merchants, never by the farmers who eventually till the land. The tradition of the individual carving out a homestead from wild lands, so familiar in the West, has never been known in the Okayama Plain. This has been due in part to the complexities of paddy construction and to the proportions of the physical obstacles that have had to be overcome in reclaiming wild lands of any size. Large groups properly financed and directed have been needed to tap the rivers, to build intricate irrigation systems, and to lay out new paddies.

Third, successful reclamation reflects the reduction or eradication of difficult natural obstacles by improved engineering techniques. In Kojima Bay this has meant better dikes to keep rivers enclosed in a permanent course and rock barriers in the bay to speed and direct sedimentation. The blossoming of reclamation works in the seventeenth century was paralleled by improved dike design and construction.

EARLY SETTLEMENT OF THE PLAIN[1]

The agricultural development of the Okayama Plain began some two thousand years ago with the introduction of rice and the construction of rudimentary paddies and irrigation systems.

FIG. 2. The historical sequence of reclamation in Kojima Bay. (After Watanabe.)

Prior to that far-reaching development, the early Japanese settlers apparently ignored the plain in favor of defensible settlement sites at elevations above the flood level. The lowlands were presumably little used except for their game and for the shellfish resource along the advancing seacoast. However, the introduction of rice altered this pattern drastically and made the plain the focus of human activity. First attempts were made at the drainage of small areas of reclaimable land and at the building of dikes by which river waters might be held in check. Advances must have been slow and arduously won, but by the sixth century inner stretches of the plain were occupied and under the direction of leaders whose keyhole-shaped tombs still dot the plain.

Fragmentary evidence shows that a few north and south Chinese emigrants participated in early reclamation and presumably spread a knowledge of advanced irrigation techniques brought

[1] Details of the early stages in the historical development of the Okayama Plain and Kojima Bay reclamation are drawn from Shigezo Watanabe: "Okayama heiya no kaihatsu (The Development of the Okayama Plain)," *Chiri Ronso*, Vol. 3, 1934, pp. 235–276.

with them from the continent. Their presence stresses the central position of the Okayama Plain in the core area of Old Japan and the use of Kojima Bay, then a protected indentation in the coast, as a leading anchorage for ships plying between the Japanese capital at the eastern end of the Inland Sea and outlying areas in western Japan and the east China coast. Proximity to the capital also resulted in the imposition of the *handen*, or *jori*, system of land division in the middle of the seventh century. Remnants of the rectangular layout of this system of regulated land division can still be traced in the settlement forms west and northeast of Okayama City and north and west of Saidaiji. This provides historical evidence that these two localities in the central and eastern part of the plain already had the most densely settled agricultural lands. The restriction of private ownership under the *handen* apparently had a negative impact on land reclamation, which slowed to a standstill until a century later when the small-scale reclamation of swampy tracts was revived under the manorial system.

Names of administrative sub-divisions preserved in records of the tenth century show a thin veneer of settlements across the inner plain. Presumably the most easily drained areas were reclaimed and settled first, leaving intervening swamps and low-lying areas to be brought under cultivation later. During the following five centuries this was accomplished, but in a hectic fashion because of the intermittent warfare that plagued all Japan. Fighting sometimes interrupted agricultural activities, yet gradual population increases seem to have compelled continuing interest in the conversion of wild lands into productive paddy. By the middle of the sixteenth century the best areas were already in crops, and with peace replacing strife attention was turned to the shallow waters of Kojima Bay as a new source of land.

FEUDAL PERIOD RECLAMATION

In 1573, Ukita Naoie, a feudal lord, built a castle in Okayama City (formerly Izushi) after conquering the surrounding countryside, and set in motion a series of benevolent economic measures to enrich his fief. One of these measures, in 1585, was the first reclamation of shallow Kojima Bay borders, in a convenient location east of Kurashiki. Hills enclosed 100 acres of tidal flats on three sides, so that, by building a rock dike across the remaining narrow neck, sea water could be excluded and paddies constructed. Irrigation canals were also dug to carry water from the Takahashi River to the new area. Although small, this project was a pioneer in dike construction and coastal reclamation in western Japan, and in later years served as a model on which refinements in engineering technique were based.

With the beginning of the seventeenth century Japan entered a period of protracted peace under a feudal order dominated by the ruling Tokugawa clan. Among the more remarkable economic developments during the following 250 years of feudal controls was the rapid and widespread reclamation of seacoast and swampy tracts for *shinden*, or "new paddies," as reclaimed areas were popularly known. Other than the normal urge to accumulate increased wealth in the form of rice income, the appetite of local lords for more agricultural land was whetted by a variety of motives.

After 1600 there were frequent, often drastic, revisions and redistribution of fiefs among the many feudal clans. Many clans had their domains reduced in size or were uprooted from familiar territories and moved to smaller and

poorer fiefs. The reaction in many cases was to set in motion measures by which the economic position of the inferior fiefs could be improved. Improvement attempts usually involved expanding rice acreage and commercial activities and encouraging specialty production in both agriculture and manufacturing. Economic development work of this sort reached a peak during the seventeenth century but continued on a reduced scale until 1867.

The Tokugawa did their utmost to weaken the economic, political, and military strength of the feudal clans by requiring costly periods of residence in Edo (modern Tokyo) and frequent contributions for extensive public works. Impoverished, many lords tried to increase their rice income through paddy improvement and expansion. Finally, the peace and prosperity of the early years of the feudal era resulted in rapid population increases that prompted public demand for new agricultural land. Additional rice supplies were badly needed to accommodate growing urban populations.

Reclamation in Kojima Bay was carried out during most of the feudal era, although sporadically, under the enlightened Ikeda clan of the Okayama fief. By the opening of the seventeenth century the Fujito Channel linking the western end of Kojima Bay with the Inland Sea had been blocked by silting. The resultant reduction in bay current velocity produced calmer waters that encouraged rapid sedimentation in the bay interior. Bayside reclamation works, among the largest and most famous in Japan, were undertaken in those areas where sedimentation was most advanced.

Over a period of 60 years 10,000 acres of new land, about three-fourths of it paddy, was added to the Okayama Plain. The speed and success of the bay projects was due in large part to the size of existing expanses of easily drained offshore waters. Little difficulty was experienced in transforming these shallow waters into arable land. Sediments between the Asahi and Yoshii Rivers were especially well developed and accounted for 40 per cent of the land reclaimed.

A long slender strip of almost 2000 acres west of the Asahi River was reclaimed initially. Next, the first units of the area between the Asahi and Yoshii Rivers, eventually to total 4350 acres, was undertaken, followed by 1840 acres in two sections at the western end of the bay. From here, attention shifted to 1470 acres east of the Yoshii River, then, finally, to completion of additional units between the Asahi and Yoshii Rivers.

Land reclamation slowed by the end of the seventeenth century. During the remaining one and one-half centuries of the feudal era only 1760 more acres along the western coast of the bay were reclaimed. This abrupt decline, matching the earlier dramatic upsurge of interest in land development, was partly due to the exhaustion of long stretches of good alluvial deposits. Therefore, subsequent reclamation had to be paced in accordance with the rate of sedimentation.

A further explanation was stabilization of population during the second half of the feudal era, thus reducing public demands for new land. The reclamation movement eventually fell into disrepute in official circles because of the labor problems it created. Farmers often abandoned their holdings in older villages in favor of larger, newer properties in reclaimed areas. New lands were highly prized, as seen in the typical place names given new villages in which the characters for "happy," "good fortune," "prosperity," and

others denoting a rosy economic future were preferred.

Difficulties in financing also played a role in the reclamation decline. The Ikeda clan had become so poor as a result of its feudal obligations and its fief investments that heavy loans had to be sought from rich Osaka merchants. This resulted in the rise of merchant power at the expense of the military, even to the point where many merchants were collecting rentals from feudal properties allotted them in partial repayment of noble indebtedness. In the Okayama fief, as elsewhere, the pace of reclamation was slowed by the difficulty in getting the large sums of money needed for land development, and the unwillingness of the lords to permit the rising merchant power to operate unchecked.

MODERN PERIOD WORKS

Continued Kojima Bay reclamation has been carried out since 1868 by two agencies, the private Fujita Corporation and the national government. As heirs of the Tokugawa period tradition, the Fujita group were responsible for some of the best-planned and far-reaching Kojima Bay developments.[2] It carried through expensive reclamation in keeping with a carefully formulated blueprint of action, applied modern engineering techniques in dike and paddy construction, and pushed farm mechanization in some of the reclaimed areas to a degree unique in Japan. Fujita operations did not begin until 1899, but were continuous until loss of all the company properties in the land reform of 1947. The national government took over the bay project in 1947 and is now carrying it to completion. The Okayama prefectural government also participates, selecting settlers and handling all aspects of land management once reclaimed land is declared ready for agricultural use.

The sequence of reclamation operations has followed the recommendations of a Dutch engineer who surveyed the bay in 1880 and, in general, is based upon the sedimentation rate in various parts of the bay. Unlike the feudal era works, which were concentrated along the north central and eastern bay coasts, modern projects have worked on the inner reaches of the bay. The first project, 1140 acres in the southwestern corner of the bay, was finished in 1905 after six years of work. During this same period progress was made on 3165 acres along the western and northwestern coast; finished in 1912, most of this land (Area 2, Fig. 3) was incorporated within the boundary of newly established Fujita Village, named in honor of the reclamation company. Between 1933 and 1941, 2965 acres west of the Asahi River were reclaimed (Areas 3 and 5). A few preliminary measures were done on the two remaining sections, Area 6 (2260 acres) and Area 7 (4040 acres), by a semi-official government agency during the World War II, but work was not undertaken in earnest until the postwar period.

Twice during the modern period enthusiasm for reclamation has been engendered by depressed economic conditions. Immediately after the end of the feudal era the new Meiji government was faced with the problem of finding employment for the displaced warrior class. In Okayama it was proposed that Kojima Bay reclamation be revived as a public works program to give temporary employment to former retainers of the Ikeda clan and eventually to provide land on which warrior fami-

[2] The Fujita Corporation role in reclamation and land management is traced in Tsuneyoshi Inoue: *Kojima-wan kaikon-shi* (History of Kojima Bay Reclamation), Osaka, 1933.

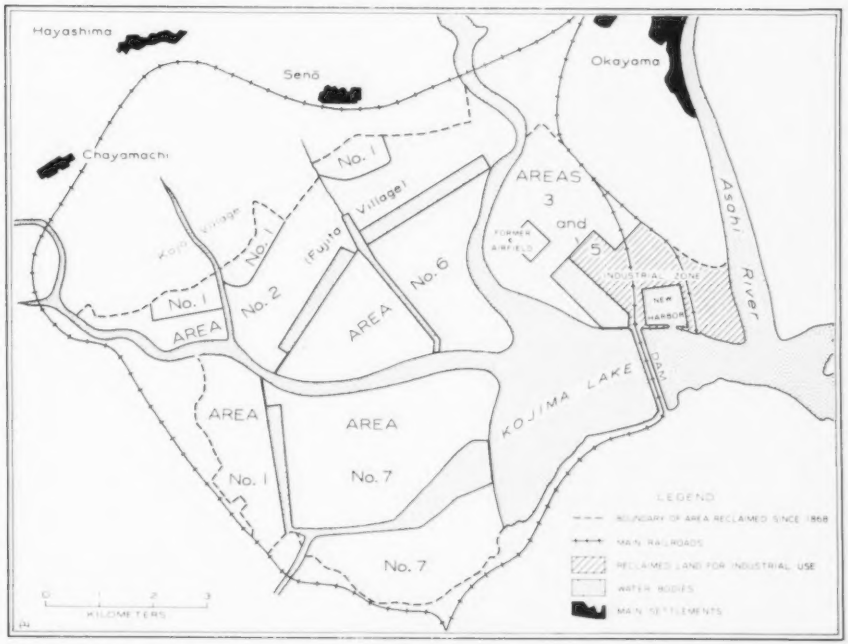


FIG. 3. Modern period reclamation in Kojima Bay. Final units (Area 6 and Area 7) and Kojima Lake dam are scheduled for completion in 1956.

lies could be settled. Despite a warm reception, the proposal was not acted upon because of the acute shortage of funds. Not until 20 years later was a group of Osaka businessmen persuaded to underwrite the project.

The more recent interest of the national government in Kojima Bay reclamation was stimulated by the desperate internal conditions during the years following World War II. Commerce and industry were at a standstill, leaving most of the economy oriented toward the production of food. Therefore, Kojima Bay reclamation was pushed to increase food production and to give employment and land to local families and to some of the soldiers and repatriates pouring home from the lost empire overseas. It is doubtful that Kojima Bay reclamation would have attained its present proportions if it had not had value as a relief measure in troubled times.

Before the Fujita Corporation could begin operations in 1899, local opposition to further Kojima Bay reclamation had to be overcome. The most spirited opposition came from bay fishing interests. The bay has never been noted for its large fish catch, but it yields some eel as well as shrimp, crab, and other shellfish. These products find ready sale in near-by urban centers. Furthermore, it was argued that the shallow waters of the bay were an excellent breeding ground for larger food fish taken in the Inland Sea, so that their elimination would be a blow to the local fishing industry. Only after a long court battle did the Fujita interests prevail.

There was also a widespread notion that reclamation would lead to serious

flooding in the lower courses of the rivers emptying into Kojima Bay despite claims to the contrary by engineers. Some objections were also voiced by small shipping interests whose boats plied between the bay and the lower river courses. In agricultural circles Fujita opponents claimed that water supply and drainage problems were already too much of a burden without the addition of more reclaimed land.

Engineering techniques used in the Fujita operations were relatively simple. Dikes made of stone quarried on Kojima Peninsula were erected around areas to be reclaimed. Water enclosed within the completed dikes was drained gradually at low tide through gates, which were then closed as the tide rose. More recently, pumps have sped drainage at late stages in the reclamation. Because sedimentation was not well advanced when reclamation began, there is a distinct bayward slope to final units now under construction. Differences in elevation and slope among the areas reclaimed at various past periods has been responsible for serious irrigation and drainage difficulties.

The precarious water balance in newer reclaimed areas is often upset by destructive natural forces. For example, in January, 1947, a mild earthquake caused a 25–40 centimeter subsidence in a few localities around the bay. The drainage and irrigation systems were so disturbed that pumps must still be used to drain seawater that seeps into the canals. Dikes are of a vertical type with minimum bayward slant. They are cheap to construct but have proved overly vulnerable to wave action. Fortunately, the Kojima Peninsula highlands protect the bay lands from typhoon winds and help keep down wave action. Their presence and a moderate tidal range of eight feet have been contributing factors to the ease with which reclamation has been effected.

WATER PROBLEMS

Severe water shortages in reclaimed lands around Kojima Bay have resulted in farmer distress and a marked reduction in land productivity. Shortages stem from unwise dependence upon water from the Takahashi River, which supplies most paddies in the western Okayama Plain. It is now clear that most of the Takahashi water is consumed by other irrigation cooperatives before it can reach the bay fringes. Newly reclaimed lands are thus left with insufficient and variable water supplies for irrigation. More dependable amounts of water are delivered to Fujita Village by a canal tapping the Asahi River north of Okayama City. However, shortages elsewhere are critical; no water at all is available in areas now being reclaimed (Area 6 and Area 7). Water shortages have always been a depressing feature of farm life around the bay. At times of severe drought, as in 1924 and 1939 when only one-fourth the normal rice crop was harvested, the economy of bayside areas has been hit hard.

It was generally known by the opening of the modern period that a balance had already been reached between paddies served and available irrigation water. However, the Fujita-proposed solution was a series of large rectangular reservoirs within the reclaimed areas. These were built, but have since proved a failure because of the unusually heavy water demands by farmers intent on removing the heavy salt deposits in the soil. Even now, after 40 years of cultivation, a salt pan lies a foot below the surface of the first paddies reclaimed under Fujita auspices. Because of salt seepage from below, especially during long, dry spells, irrigation water soon

FIG. 4 (upper left). Typical rain water collection and storage facilities, Fujita Village.

FIG. 5 (upper right). Terminal section of Kojima Bay dam, Kojima Peninsula. Dam will be crossed by both a road and a railroad. (Courtesy of University of Michigan Center for Japanese Studies.)

FIG. 6 (lower left). Sea edge of reclamation in Area 6, showing what will later be a main irrigation canal. Mountains of Kojima Peninsula in background.

FIG. 7 (lower right). Irrigation canal and dispersed houses in older reclaimed area, Kojo Village.

becomes too saline for use. Rice has little tolerance for salinity; it can survive only if irrigation water has a salt content of less than three-tenths of one per cent, and its growth is retarded by even a smaller percentage. One of the most time-consuming duties of the settler on newly reclaimed land is systematic flooding and drainage of his paddies to remove as much salt as possible before initial cultivation.

A permanent solution to the irrigation water supply problem appears imminent with the conversion of the remainder of Kojima Bay west of the Asahi River into a fresh water lake. Construction of a dam across the narrow neck of the bay is already under way. When finished in 1956 it will result in a body of water covering 2700 acres. With excellent hindsight, most planners now feel that the dam should have been built at an earlier stage, thus creating better economic conditions in the bay region. The level of the lake, controlled by 11 large gates, will eventually be 80 centimeters higher than sea water to the east during the flood season and 50 centimeters at other times. Saline bay water initially trapped after dam completion will be replaced by fresh water from the streams and small rivers now entering the bay from the west.

The new lake will be a welcome addition to the resources of the bay

region. Besides supplying most of the water for final reclamation projects it will provide supplementary irrigation water in seven neighboring towns and villages. Anticipated food increases in the 12,600 acres involved will be 264,500 bushels of rice and 55,400 bushels of dry grains.[3] The lake also may have some industrial utility. It has been proposed that lake water be pumped into a reservoir in the center of Kojima Peninsula from where it could move to the industrial zone around Uno, on the Inland Sea coast.

The problem of household water supply remains unsolved. Rain water collected from roof runoff is now the main source, and almost every house is equipped with gutters, filters, and concrete storage tanks in this vital quest. The relatively few wells located along the inner fringes of the reclaimed zone are patronized only in time of water crisis because of their distance and because of the fees levied by their owners. A few rich farmers in reclaimed lands have invested in shallow wells equipped with large filters that allow use of canal water. Such special facilities are too expensive for the average farmer. The Fujita Corporation attempted to alleviate water shortages by keeping a fleet of small water barges plying between the Kojima Peninsula, where water is plentiful, and the reclaimed lands. Casks of water were then sold to householders at a token price. This practice was discontinued in 1940, leaving the farmer to the mercy of the weather and the storage capacity of his water tank.

SETTLEMENT LAYOUT

Most settlements on the reclaimed lands are dispersed, with each house situated in the midst of, or adjacent to, family land holdings. This is in sharp contrast to other parts of the plain, where settlements are tightly compact or semi-dispersed. Deviation from the traditional compact form, which facilitates economic transactions and agricultural cooperation, is explainable by the poverty of settlement sites and transportation facilities in lands reclaimed during the feudal era. The absence of wells and extensive elevated sites in the new lands discouraged settlement concentration and prompted the dispersal of houses along the main canals. There drinking water, firewood, and agricultural goods could be moved easily by small boats along the canal system.

A dispersed, rectangular layout, with straight lines of houses paralleling the main canals, has also been adopted in recent bay projects. Three and one-half acres or four acres in a single block are now alloted each household, but if experiences in older villages are repeated and present land controls relaxed, holdings will eventually become more variable in size and more dispersed through land sale and transfer. Since the war, allotment of reclaimed land has been made in advance of project completion. As the sea water recedes the selected settlers are not far behind, clearing reeds from their property and mounding earth for their house site. Many of the newest settlers are former fishermen, deprived of a living by the reclamation, and younger sons, wanting to establish a separate, or branch, household.

In the haste to get settlers established and land in production, no formal purchase price for more recently reclaimed land has yet been set by the government. However, land management authorities feel that it will probably average about 150 dollars per acre, which is a reasonable, moderately-high

[3] Estimates provided by the Okayama prefectural office, 1953.

price in terms of present controlled land prices. The figure is especially generous since it is costing the government an estimated 3000 dollars per acre to reclaim Kojima Bay land in the postwar period. This does not include housing and equipment subsidies granted new settlers.

The reclaimed areas are served by an excellent road system over which passes a heavy truck, motorcycle, bicycle, and cart traffic. One of the inconveniences of the dispersed layout is that high transportation costs must be borne by farmers for the delivery of supplies and the movement of agricultural products. Farmers in older reclaimed areas use small boats to move agricultural goods short distances, and foot bridges across the main canals are elevated to facilitate water movement. Similar use of the canals in newer areas has been ruled out by the abundance of irrigation control devices. All wood and fuel must be imported from Kojima Peninsula or other parts of the prefecture, and its cost has inspired specially-designed stoves burning rice straw and hulls. However, the use of straw for fuel leaves none for compost, so that chemical fertilizer purchases are heavier in the bay region than in any other part of Okayama Prefecture.

The economic life of the reclaimed lands is oriented toward a trio of towns west of the bay: Seno, Hayashima, and Chayamachi. All three towns are linked with Okayama City and other urban centers by prefectural roads and the Uno Line, a short rail line between Okayama City and the port of Uno. Apart from their general service function, the towns are specialized marketing centers for reeds (*i-gusa*) and reed matting (*tatami omote*) used in the manufacture of the mats that cover Japanese floors. Both products appeal to an established national market and are an important secondary source of income in the older reclaimed lands. Chayamachi alone has a more diversified economy, because of its small cotton spinning industry begun in the early years of the modern period.

FUJITA VILLAGE

Fujita Village has had two unusual features in its development that set it apart from other Kojima Bay reclaimed lands and other agricultural areas in Japan. Until the land reform in 1947 the entire village and additional neighboring properties were owned and operated by the Fujita Corporation, the largest block of agricultural land held by one group in Japan. Also, Fujita Village and neighboring Kojo Village have become the most highly mechanized farm areas in a nation noted for its intensive hand cultivation.

After the opening of Fujita Village in 1912, reclaimed lands were operated on two different bases. Some land was share-cropped whereas the greater share of the corporation's 2000 acres was worked as a company farm. Under the share-crop system, 3 to 6 acres were alloted to each participating household, with 60 per cent of the harvest reverting to the corporation. Despite the large acreage allowances, the period of corporation control, marked by unreasonable exploitation, is remembered with bitterness by participants.[4] The corporation has attempted to explain its harsh economic policies by use of the phrase *kaitaku sandai*, "three generations for reclamation." The implication was that theirs was a long-term investment and that they had to use every opportunity to get back their investment

[4] Evident in a series of individual and group interviews in Fujita Village and Kojo Village in 1950. Other facts gleaned from these interviews are incorporated in the following discussion.

FIG. 8 (upper left). Typical scene along secondary irrigation canal in recently reclaimed area.

FIG. 9 (upper right). Typical farmhouse layout along canal, Fujita Village. Open area enclosed by house, barn, and canal is essential for drying crops and other activities requiring considerable room. Barn is to the right.

FIG. 10 (lower left). Farmhouse in Fujita Village, showing strong orientation of life to canal.

FIG. 11 (lower right). New settler's house erected with government assistance in recently reclaimed land. Frame construction is covered with bamboo and plastered with layers of mud reinforced with straw.

as rapidly as possible. Oppressive measures were relaxed only through spirited farmer protests and the land reform of 1947.

Disputes over the high share-crop rate flared intermittently, with local farmer groups receiving support from the national Farmers Union. Also, many other oppressive measures fanned farmer discontent into flame. For example, a demand was issued that all sharecroppers spread their rice harvest along the dikes for inspection so that they would have no chance to secretly store some of the harvest for personal use. Ten farmers were sent to prison for resisting this regulation despite their reasonable pleas of labor shortages. Finally, opposition became so widespread that sharecropping was abandoned in favor of a tenancy system in 1928. Land was leased only to those farmers who had remained quiescent in the earlier farmer-management friction. The most outspoken "radicals" were expelled from the Fujita property, some of them emigrating to Korea. The tenancy system, with rentals set at 40 to 50 per cent of the harvest, continued until the land reform replaced it with independent farmer tenure arrangements.

One thousand acres were also operated continuously as a company farm

using day laborers. After the China Incident in 1937, military service drained off most of the Okayama labor surplus, leaving the company farm short of workers. During World War II, school children and women's associations worked as part-time laborers in the company fields as a patriotic move to bolster food production. Local farmer groups were unsuccessful in a strong wartime bid to have the prefectural government compel the Fujita Corporation to sell part of its holdings to cultivating tenants and independent farmers. The Fujita group managed to weather the storm, but before they could exploit the masses of unemployed young soldiers returning from defeat in the war the land reform program was set in motion by the Japanese government. The company farm and tenant properties were purchased by the government and sold to tenants, repatriates, and former soldiers at low prices.[5]

One positive contribution of the Fujita Corporation to the local economy was the introduction and continuous use of farm machinery. The first mechanized implements were imported from the United States in 1909, and after initial experiments proved successful all company farm operations were mechanized to cut labor costs. The large size and continuous nature of the Fujita holdings made possible the application of modified western cultivation techniques, and the company had enough funds to embark on a long-range machinery purchase program. Rototillers were among the first and most numerous machines bought to work the hard clay on reclaimed lands. Gasoline and electric motors and other farm machinery were added gradually. Oldtimers in Fujita Village are now organized in groups of five to share one rototiller, while newer and poorer farmers often rent them by the hour or depend entirely upon animal labor.

Company operations in Kojo Village, combined with interest in machinery generated among independent farmers, has made Kojo the most mechanized village in Japan, with Fujita Village a close second. A few pertinent statistics show the importance of motors and mechanized farm equipment in Kojo Village. In 1953 among 1210 households there were 648 rototillers, 992 power threshing machines, 121 power-driven hulling machines, 1124 gasoline motors, and 1047 electric motors.[6] Once introduced in the reclaimed lands, mechanization has rapidly spread in lesser degree throughout the Okayama Plain. Gasoline motors are a common sight everywhere and much mechanical power is now used to do heavy farm labors once done by hand.

A farm mechanization policy is planned for the final bay areas now being reclaimed. The government has announced that it will provide every fourth household with a rototiller, or one for every 16 acres, one power thresher, one power sprayer, and one three-wheeled motorcycle. Gasoline motors and pumps will also be made available, all on a liberal 20-year repayment basis. Thus, there is strong indication that continued local expansion of mechanization can be anticipated provided promised governmental supports are forthcoming.

LAND USE IN RECLAIMED AREAS

Reclaimed lands around the bay are cultivated intensively, with rice the principal crop wherever water supplies

[5] A comprehensive report of land reform proceedings is Agricultural Administration Research Office, Ministry of Agriculture and Forestry: *Fujita nojo no kaiho temmatsu* (Summary of the Emancipation of the Fujita Farm), Tokyo, 1950.

[6] Okayama prefectural government statistics.

permit. However, because of the erratic water delivery and salinity of the soil, rice and dry grain yields are generally lower than in older parts of the plain. Dry fields are so neglected that vegetables must be purchased from specialized vegetable zones in Kojima Peninsula.

While double-cropping is now standard, the Fujita Corporation holdings were long a notable exception. The company decided that low wheat prices did not warrant interest in a winter planting and many of their tenants were unwilling to double-crop their land because of the large share paid to the landowner. The turning point was the compulsory crop delivery system begun by the government in 1940–41. Compliance with the regulations of this system forced adoption of double-cropping. The farmers around the bay now count upon income derived from the winter crop as an economic mainstay, so there is apparently little possibility that the single-crop system will reappear.

Since the relaxing of grain delivery quotas in 1950, more farmers on the reclaimed lands have been turning to winter crops that earn them additional income. *I-gusa*, the reed used for floor matting, is by far the most popular cash crop and is grown in increasing amounts. Its cultivation involves a heavy labor input and can be risky, but cash returns are dependable. Furthermore, fashioning the reed into matting at home on a foot- or machine-powered loom provides off-season employment.

Dry farming predominates in Areas 6 and 7, now under reclamation, because of water shortages. Once irrigation water is available from the big lake that will eventually replace Kojima Bay a land use pattern similar to that of adjacent older areas can be anticipated. In the interim, 400 acres of cotton are planted during the summer for sale as lining for quilts and winter clothing. The reappearance of cotton in the bay region is an interesting throwback to the feudal and early modern periods, when it was the leading local cash crop before losing in the competition with cheaper, imported cotton. Because of water and labor shortages, *I-gusa*, normally tolerant of saline water, is not yet grown on reclaimed parts of the two areas. Vegetables are grown wherever possible for home use and for urban sale. In summary, farming is still a secondary consideration in these two reclamation areas. Although settlers have already raised their houses on some of the new lands they depend on income from reclamation jobs until water can be obtained from the fresh water lake for their untried paddies.

Industrial Use of Reclaimed Land

A large tract of reclaimed area adjoining the west bank of Asahi River has been reserved for expansion of the Okayama City industrial belt. During the war much of this tract was covered with six feet of dirt for construction of a military airfield and four factories needed in the war effort, rendering it unfit for later paddy use. Provisions have also been made for the development of port facilities superior to the riverside docks currently used in the Okayama City waterfront.

Okayama City, with a population of 160,000 in 1950, is the leading urban and industrial center of both the plain and prefecture. Prior to 1573 it was a small sprawling town noted for its central market and location along one of the three main rivers leading into the interior but developed rapidly as a political and economic control center. The construction of fortification, improvement of local agriculture, concentration of artisans and merchants, and

FIG. 12. General view of Kojima Bay industrial tract, looking west, with Asahi River in foreground. Also visible are the new Okayama port, mountains of Kojima Peninsula, and terminal sections of the dam bridging the narrow neck of the bay. (Courtesy of University of Michigan Center for Japanese Studies.)

benevolent economic policies of the Ikeda clan all contributed to its rise. During the modern period further economic stimulus has been provided by rail lines putting it within easy reach of the resources and markets of western Japan. Still in an intermediate stage of industrial development, the city has attracted cotton and synthetic fiber mills and a variety of small consumer industries.

In developing the new industrial tract, the prefecture hopes to attract large industrial concerns that will diversify the city's industrial economy. Thus far, a large synthetic fiber plant and a chemical factory, both fronting on the river, have been erected, while the bay front has attracted a wood treating plant and gasoline storage facilities. Remaining portions of the tract can accommodate between five and ten new industries, depending on their size. The prefecture has stepped up its advertising campaign in the best tradition of the American chamber of commerce to lure new industries.

The new industrial tract has many locational advantages. Okayama City and surrounding farm areas have a larger labor surplus than does the Osaka-Kobe region. Continuous and well-regulated industrial water supplies provided by the Asahi River will be vastly improved with the approaching completion of two large multi-purpose dams upstream. Plentiful power comes from small hydro-electric plants in the interior, a thermal plant near the mouth of the Asahi River, and main electric transmission lines from Kobe. Coal deliveries must move only a short distance by rail or barge from northern Kyushu. General transport facilities are unexcelled; rail lines extend to all parts of the country and deep-water

docking facilities at Uno on the Inland Sea and at the new Okayama City port facilities are now under construction. A new rail line to be built between Okayama City and Uno will pass through the new industrial tract and across the Kojima Bay dam, thus providing faster movement between the city and its outport.

Port facilities at the western edge of the industrial tract now can handle 200,000 tons of small shipping annually, but when expanded will have a potential of five times that amount. Dredging will allow the entry of medium-sized freighters instead of limiting traffic to ships under 1000 tons, as is now the case. An area west of the industrial tract will be developed as a housing, shopping, and recreational area for 30,000 people, with preference given to the labor force manning new industries.

Future of the industrial development appears bright as there is sound management and intelligent planning. However, much of its success will depend upon how well it can compete for industries with other emergent industrial zones in southern Okayama. In the eastern plain there is little competition; Saidaiji, once a thriving control point along the Yoshii River, has faded into obscurity as a religious center. But along the lower Takahashi River, in the western plain, Kurashiki is rapidly becoming a textile leader, and Tamashima boasts a small though thriving industrial complex. Both are anxious to attract other industries. The Inland Sea city of Tamano, which includes the Uno port facilities, has the advantage of sea frontage in its bid for increased industrialization. Each of these locations has attractive qualities and should expand its industrial activity in the future. At present, however, Okayama City holds the best prospects for rapid industrialization, since in its industrial tract, reclaimed from Kojima Bay, it has an industrial asset unmatched by competing centers.

ACKNOWLEDGMENTS

Final drafting of maps was done by Mr. Robert P. Hinkle of the Cartographic Laboratories, Department of Geography, University of Washington.

ECONOMIC GEOGRAPHY AND THE MANUFACTURING INDUSTRY OF NORTHERN IRELAND

Morgan D. Thomas

Dr. Thomas, who did his graduate work at the Queen's University, Belfast, is an instructor at the University of Michigan, where he holds a joint appointment in the Department of Geography and the School of Natural Resources.

IN this paper it is proposed to indicate briefly a method which was recently used to study the economic geography of manufacturing industry in Northern Ireland,[1] and to mention some of the conclusions reached from this analysis. However, as economic geography has many meanings a short examination of some concepts and approaches to this subject is desirable.

Approaches to Economic Geography

Economic geography is often associated with such authors as Chisholm and J. Russell Smith. Many of the popular textbooks on this subject are focused on trade, and usually contain long lists of exports and imports (often many years out of date) as well as descriptions of ports and trade routes. Other economic geography textbooks primarily describe various industries, production methods, and the distribution of raw materials and mineral resources. Usually these studies are weak in causality and often ignore the human aspects in the industries or features of the economy studied. Perhaps the weaknesses of these writings can be attributed to the authors' concepts of economic geography and the approaches used.

Josiah Stamp, although an economist, reflected the views of many geographers when he said that economic geography should be "confined to describing the geographical aspects of physical and spatial facts."[2] This is "the locate and describe" advice given by Ritter to geographers, and as such it is a superficial treatment. The approach to economic geography suggested by Stamp and used by many geographers was that "economic geography must begin with physical environment, because these natural controls are dominant."[3] Stamp was illogical, as in his definition of the subject he restricted himself to the descriptive aspects of "physical and spatial facts," and yet the approach which he suggests indicates that he believed a causal analysis should be made. Furthermore, such a deterministic approach immediately prejudices the search for *all* the factors and their *degree* of influence.

The lack of development of the subject in the past may also be partly attributed to misconceptions about economic geography. It has been said that economic geographers should provide bricks for economists to build with,[4]

[1] M. D. Thomas: *The Economic Geography of Manufacturing Industry in Northern Ireland.* Unpublished Ph.D. thesis in Geography. Queen's University, Belfast. May 1954.

[2] J. C. Stamp: "Geography and Economic Theory," *Geography*, Vol. 22, 1937, p. 1.

[3] *Ibid.*, p. 4.

[4] *Ibid.*, p. 1.

or provide a physical basis to hold the economists' feet to the ground.[5]

But the geographer's purpose should not be simply to accumulate facts, and fix them spatially. He should use such facts to provide himself with the empirical basis for inductive reasoning, and to check the results of deductive thinking, for, notwithstanding his physical base, the geographer is himself often guilty of becoming "airborne!"

CAUSAL ASPECTS

Professors Wooldridge and East recently wrote that a geographer's task is interpretation. He must answer the questions "where?" and "why there?" Yet this work cannot be carried out successfully if the advice they give is followed. For example, they say that "the knowledge of the processes that take place inside a blast furnace in no sense confers an 'economic' aura on geographical work; it merely supports such work with a little technology. It is desirable knowledge, but economist and geographer alike can, in the final analysis, take manufacturing processes as given: it is enough that suitable mixtures of ore, limestone and fuel yields the required product."[6] However, if the question "why there?" is to be answered then a knowledge of the proportion of the minerals used in the mixture may be necessary. Walter Isard showed recently[7] that the cost ratios of each mineral towards the total cost of production and changes in their structure have a great influence on the location of the iron smelting industry in parts of the United States. Therefore, an attempt must be made to seek and use all relevant information that will help to explain the patterns described.

In 1935 Professor R. O. Buchanan wrote that if the "view that geographical values depend on the cultural stage achieved by the human actors" is accepted, then "it will follow that the geography of production must be a study of the interaction of geographical and economic conditions in the area and for the products concerned."[8] These concepts mark an advance in the field of economic geography, especially in seeking causal relationships. However, although the importance of cultural level is accepted in trying to understand the patterns of economic activity, it is not always the key to such an understanding. Furthermore, one cannot agree that "the geography of production" is simply the study of the interaction of geographical and economic factors. If the aim is to investigate the causes for the existing or past economic patterns resulting from such production, surely one cannot begin such an analysis by acknowledging the existence of only two causal factors. Such an approach leads to the possible over-emphasis of the influence of such factors. It would be better to begin by accepting the fact that the patterns are the result of the interaction of many factors, and then to conduct research to find out which are the causal factors, and see whether they vary in nature and influence both in time and space. The analyst's mind should then be free of any taint of determinism or bias. It must be remembered, however, that human beings are handicapped by their inability to grasp the wide range of such interacting factors. Therefore, the studies are usually contributions and not the complete

[5] O. E. Baker: *Proc. Amer. Econ. Assoc.*, 1926, p. 113, quoted by Stamp *op. cit.*, p. 2.

[6] S. W. Wooldridge, and W. G. East: *The Spirit and Purpose of Geography*, London, New York, 1951, p. 114.

[7] W. Isard and J. H. Cumberland: "New England as a Possible Location for an Integrated Iron and Steel Works," *Econ. Geog.*, Vol. 26, 1950, pp. 245–259

[8] R. O. Buchanan: "The Pastoral Industries of New Zealand," Inst. of Brit. Geog., *Transactions and Papers*, Publication No. 2, 1935, p. xv.

answer to the problem. All relevant factors which had an effect on the formation of the patterns should be considered and assessed. To return to Professor Buchanan's article, one wonders whether he could examine the causal relationships within the "Pastoral Industries of New Zealand" without considering the implications of the country's political ties with Great Britain?

C. A. Fisher indicated his dissatisfaction with the current content and approach to economic geography in a recent paper. He defines the subject as "the study of spatial distributions of economic activity considered in relation to other spatial distributions."[9] Fisher wants "a shift of emphasis from trade to production . . . a movement from commercial to economic geography."[10] Later he suggests that the method of analysis should be through the state which "forms the essential major unit of study." Fisher believes that with regard to economic distributions "political ideas and distributions lie at the heart of the matter."[11]

Without doubt there is a radical element in these ideas which could be investigated. One notices that Fisher uses "economic" to denote economic activity rather than in the sense of economic factor. If one of the purposes of a geographer's work is to explain the patterns resulting from economic activity, then this distinction indicates an advance which should liberate him from thinking of the problem in such a restricted manner. However, Fisher is not emancipated in that he regards the political factor as the most important in explaining the patterns. He does great service in pointing out the significance of such a factor, but he errs in thinking that it is always "at the heart of the matter," for the influence of the political factor varies in historical and contemporary times both in space and in intensity. Other factors, social, historical, economic, geographical, etc., may have exerted an effect to a greater or lesser degree on the form and structure of the patterns.

[9] C. A. Fisher: "Economic Geography in a Changing World," Inst. of Brit. Geog., *Transactions and Papers*, Publication No. 14, 1948, p. 79.
[10] *Ibid.*, p. 80.
[11] *Ibid.*, p. 83.

Whole Field of Economic Geography

Many works having a bearing on the economic activities of society show a lack of true perspective and balance. Often one aspect of society's economic activity is treated as if it were the whole field of economic geography. This is suggested by Buchanan when he speaks of it as the "geography of production," and Fisher when he stated that there was need for "a shift of emphasis from trade to production . . . a movement from commercial geography." But economic patterns are the result of society's engagement in the production and manufacturing of raw materials and from its rendering of services of various kinds (having economic value). It would be wrong to treat only one kind of economic activity in any area and then say that its whole economic geography has been covered, because a complete coverage would involve the study of *all* economic activities. Two eminent economic geographers, namely Raymond E. Murphy,[12] and Wilfred Smith[13] have emphasized this viewpoint in recent publications.

McCarty's Approach

A survey of contemporary writing in the field of economic geography re-

[12] R. E. Murphy: "The Fields of Economic Geography," in *American Geography: Inventory and Prospect*, Ed. by P. E. James and C. F. Jones, Syracuse, 1954, p. 243.
[13] W. Smith: *Geography and the Location of Industry*, Liverpool, 1952, p. 3.

veals that geographers are focusing their attention on the distributional aspects of these economic activities. H. H. McCarty, in a most stimulating paper, indicates that he believes that this should be the case, and that economic geographers should devise theories to expedite their studies. He writes, "If we are to accept the idea that economic geography is becoming the branch of human knowledge whose function is *to account for* the location of economic activities on the various portions of the earth's surface, it seems reasonable to develop a body of theory to facilitate the performance of this task."[14]

McCarty seeks to account for the location of economic activities by using the principle of association. He believes that in earlier days when the phenomena seemed considerably simpler than at present it was "fashionable" to provide an explanation by searching for causes. Because of the "complexity of locational processes" it has become very difficult to search for all the relevant causes. This search led geographers into many diverse fields of knowledge. McCarty concludes that there is "little wonder that the system (of seeking relevant causes) produced few principles! Variables became so numerous that they were not manageable, and in consequence, solutions to locational problems were not obtainable."[15] McCarty suggests a shift of emphasis from cause and effect to areal association. "No longer insistent that a, b, and c are causes of the location of x, he [the economic geographer] is quite content to find that *wherever* one finds a, b, and c, one *also* finds x."[16]

In his definition of economic geography McCarty says that the function of economic geography is "to account for" these locations of economic activities. But it is hardly an adequate explanation "to account for" a particular pattern in terms of: if a, b, and c are there, then x is also there. Nevertheless, the principle of association, when used in making hypotheses, can serve a useful purpose as an additional technique in economic geography. Because the association of two or more characteristics may vary between perfect correlation and complete absence of correlation, i.e., independence, it is essential to discover the degree of correlation between phenomena studied. Establishing such a correlation between phenomena is a worthwhile contribution towards analyzing economic patterns. Association may account for the presence of a phenomenon in terms of the phenomena with which it is associated, but this does not account for the association, and (in McCarty's case) for the location of economic activity in any part of the world.

Economic geography is a member of the diagnostic sciences. To account fully for a particular pattern, there *is* need for a search for causes, and a focusing on the antecedents of the pattern studied. Carrying out this type of analysis has practical value as well as academic interest. Discovering the causes of a pattern is to discover what needs to be altered, if there is a need to produce, prevent, or counteract it. The diagnostic role of such a study then facilitates the applied functions of economic geography.

If an economic geographer is fully to "account for the location of economic activities" then such a study does involve a study of causes, and an attempt to measure their several significances in the formation of the patterns studied. The principle of

[14] H. H. McCarty: "An Approach to a Theory of Economic Geography," *Econ. Geog.*, Vol. 30, 1954, p. 95.
[15] *Ibid.*, p. 96.
[16] *Ibid.*, p. 97.

association can perform a valuable service in indicating which are the relevant factors, but it does not permit their evaluation, which is necessary if the explanation is to be complete. Thus, there is no dichotomy between the theory McCarty advocates, and the causal approach to a study of economic activity patterns. Geographers need to know as much as possible about the processes of integration in the formation of economic patterns as well as the correlation of causal factors. For x is something more than the summation of a, b, and c.

Many economic geographers would no doubt differ with McCarty in his definition of the field of economic geography. Although it may be desirable to have agreement on this matter, it is extremely difficult to achieve such an objective, because, to a great extent, a definition of economic geography is at present a matter of personal opinion where value judgments are made, and these judgments are based on personal choice of criteria. However, as long as a person clearly defines what he understands by the term economic geography and then is guided by such a definition during the course of executing his research work, then from the methodological viewpoint he may be quite correct.

AUTHOR'S CONCEPT

Here it is appropriate to say that economic geography as defined by the present writer is the study of the pattern which results from the interaction of the economic activities of society as a whole. This involves the analysis of the economic interrelationships of industrial groups within society as well as their areal interrelationships and similarities or diversification. The causal relationships in the pattern must also be examined to give the study depth.

AN APPROACH TO MANUFACTURING INDUSTRY

The writer's concept of economic geography and his approach was illustrated in his study of manufacturing industry in Northern Ireland. But as this was only one of the economic activities in which society was engaged, manufacturing industry first of all had to be placed in its right perspective. Therefore, a brief comparison of the various economic activities of society was made so that the relative importance of manufacturing could be assessed, the chief criterion used being the number of persons engaged in the various industrial orders as classified in the Standard Industrial Classification List. The insured population[17] was conveniently divided into four sections[18] for this purpose, and because Northern Ireland is an integral part of the United Kingdom a comparison was also made of economic activity in Ulster and Great Britain.

Although manufacturing industry was the dominant section of the economy in Northern Ireland as a whole, it does not maintain this position in all parts of the Province. To examine the importance and distribution of these economic activities throughout Ulster their labor force was examined on a regional basis and the regional units used were Ministry of Labour Employment Exchange Areas. A quantitative and qualitative guide to the distribution of the activities was given by measuring the number of insured persons in the

[17] The self-employed and employee-insured population was considered. This gives almost full coverage of the working population.

[18] 1. Manufacturing Industry. 2. Service Industry. 3. Agriculture and Fishing. 4. Building and Mining.

sections within these Employment Exchange Areas.

Having briefly examined the relative position of manufacturing industry in the economy, its pattern in 1951 was then examined and it was decided to divide industry into five convenient groups[19] to facilitate their study. The method used was to analyze the importance, structure, and distribution of the various manufacturing industries. The criteria were the size of their labor forces and their financial contribution to the economy. This permitted a comparison to be made of their importance within the groups and manufacturing industry as a whole. The industrial structure was defined by the number of insured persons in the individual industries as classified in the Standard Industrial Classification List. To analyze the distribution of the industries their labor force was examined on a regional basis and the regional units used were Ministry of Labour Employment Exchange Areas. A quantitative and qualitative guide to the distribution of industries was given by comparing the number of persons engaged in the industries within these Employment Exchange Areas.[20] The dynamic nature of the industrial pattern necessitated a brief analysis of the various present-day factors which tend to bring about changes in this pattern.

To give the study greater depth an examination was also made of the interaction of the causal factors which created the 1951 industrial pattern. This was done by analyzing and evaluating the factors which caused changes in the size, structure, and distribution of manufacturing industry through time, because it is felt that these three aspects are crucial in such a study.

[19] These groups are in order of importance as sources of employment: 1. Textiles. 2. Shipbuilding, Engineering and Vehicles. 3. Clothing. 4. Food, Drink and Tobacco. 5. Other manufacturing. The contemporary manufacturing industry was later considered as a whole.

[20] Although far from being satisfactory, at the present time these areas offer the best means of carrying out this type of work, because it is not possible to obtain the position and the number employed in every firm in the Province. However, the value of field work cannot be overstressed in throwing light on so many problems encountered, and in supplementing official statistics.

SOME RESULTS FROM STUDY

The first section of the thesis showed that there was a particular type of industrial structure and distribution pattern. The distribution of long-established industries and factories could not wholly be explained in terms of present day causal factors. It was, therefore, imperative that the historical approach should be used in the second section to analyze the factors which influenced the development, structure, and distribution of industry through time. It was then possible to see how the present-day industrial pattern grew and to observe which factors influenced its shape and content. Geographers should know what causes changes in industrial structure and distribution pattern, for only then can they appreciate fully the dynamic nature of the phenomena which they study and understand how the present pattern came into being and how it may change in the future.

GROWTH FACTORS

It was political and economic pressures that mainly influenced the growth of Ulster's major industries. These pressures were partly the result of a fear of competition but chiefly due to a marked increase in world wealth, population, and trade, particularly in the second half of the nineteenth century. The rate of growth depended on the strength of the various factors which governed economic demand for manufactured goods. The special aptitude of

labor for some kinds of work, good management, improved production methods and communications, as well as favorable influences which helped to lower production costs, all tended to raise the level of demand. Economic demand for industrial goods was also influenced by the general level of wages, spending habits, prices of goods and prices of substitutes, changes in fashions, and capital development in various parts of the world. It was also seen that foreign governments had a large measure of control over their subjects' demand for Ulster goods through the use of tariffs and economic sanctions or import quotas. The dependence of Northern Ireland's chief manufacturing industries on external markets, which has always been an important characteristic, led to forces outside the Province having a very powerful influence on demand and consequently on growth. The weakness of this reliance on external markets is emphasized because Ulster industries are not major producers of the goods they produce for world trade.

Space relationships did not have any significant effect on the growth of the major industries largely because transfer costs did not form a significant part of total costs. The growth of minor industries, however, has been influenced to a greater degree by the space-relationships factor. This is particularly true in industries either using low value/high bulk or weight ratio raw materials, or producing that type of goods, and industries whose markets were limited in areal extent. There were many cases of such industries sheltering behind the "barrier" of the Irish Sea from British competitors and from internal competitors they were protected by high transport costs. The influence of space relationship on industrial growth mainly operated through transfer costs and the smaller effect these had on total costs the less influence space-relations had on industrial activity.

FACTORS INFLUENCING STRUCTURE

The changing structure of industry was partly governed by the general factors which produced a demand for various goods, but the choice of industries was also greatly influenced by Ulster's lack of raw resources. In some cases local raw materials formed the basis of an industry but this was usually during its infant stage. The major industries in the period reviewed (1780–1953) were always largely, if not entirely, dependent on external supplies of raw materials. Labor is one factor of production which Northern Ireland has always had in good supply. There has consequently been a tendency to develop industries which use a high proportion of labor such as textiles and clothing. The long traditional skill of Ulster labor in these industries has been continuously exploited. Industries which have a high conversion value/cost ratio have also been chosen and developed. This specialization in industries giving advantages in comparative costs to Northern Ireland was particularly in vogue in the period 1850 to 1930, and it has left a lasting impression on the structure of industry in Ulster.

The rate of structural change is fundamentally governed by actions of entrepreneurs and the determining factor is the speed at which they react to actual or potential changes in demand. The speed at which they react is often greatly influenced by the intensity of demand and in some cases the Government has also provided incentives to encourage changes in the structure, or placed restrictions on the development of certain industries. It was also seen that entrepreneurs in some regions were more enterprising than in others and

this led to a quicker response by them to changing conditions of demand which had far reaching repercussions on the growth, structure, and distribution of industry in the Province.

DISTRIBUTIONAL FACTORS

It is the varying nature and influence of all the causal factors in space that brings about a particular distribution of industry. The interaction of general factors, such as population growth, increasing wealth and trade, tariffs, economic sanctions, competition, etc., condition the decisions of entrepreneurs. In the light of their knowledge (which is sometimes very limited) they decide on a particular action which is then reflected in the economic activity of society. The combination of factors must be considered favorable each time a factory is built. It must be remembered, however, that the combination of factors which control the choice of Ulster as a location for a new enterprise may differ from that which governs the choice of a location for the factory within the Province. Field work confirmed that locational factors also vary in their influence from industry to industry. In some cases it was noticed that the size of factories and industries had important bearing on the strength of the various factors. It is also important to remember that usually the choice of location was controlled by a different combination of factors from that which governed the choice of a site.

The sum total of the individual decisions of entrepreneurs on the choice of location and site is reflected in the distribution of workers and factories in which they are employed. Throughout the period studied, various general factors appear to have had a controlling influence on the form of the successive distribution patterns. Other forces tend to influence the actual distribution of factories rather than the location of the industries to which they belong.

LABOR

A very striking feature of the distribution of manufacturing industry in Northern Ireland over the last hundred and seventy years is that it has been largely confined to the same regions. The geographical distribution of skilled and semi-skilled labor as well as its relative immobility has been a vital causal factor. Lower wages paid to Ulster workers was once an important locational attraction, but this has lost its significance with the growing parity of regional wage structures. Labor, however, has retained its importance throughout the period, largely through the continuity in the type of industry carried on. This is particularly true of areas outside Belfast which have specialized in textile production or one of its offshoot industries, namely, clothing manufacture. The cost of transferring plant and machinery has been an important deterrent to movement in response to changes in the favorability of a location. The continued influence of suitable labor as a locational factor of prime importance has been supported by the type of production carried out. The relatively high value of textiles and clothing enables the industries to bear the transfer costs of raw materials and finished goods. The gradual improvement in communications and a relative fall in transfer costs during the period were important factors which enabled the outlying regions with their skilled labor to retain a certain degree of locational attraction for industry.

Many new factories of British origin were established in Ulster during the last ten years. Labor in most cases was the decisive factor which governed the choice of Northern Ireland as a location. In the past it was the distribution of

skilled and semi-skilled labor which chiefly governed industrial location. Today, this is not strictly true as in most cases labor has to be trained for the work carried on in these new factories. The availability of suitable supplies of labor in Ulster is, however, proving a sufficiently strong locational force to overcome the deterring influence of extra costs, incurred in training unskilled labor. Within the Province the strength of labor supplies as a locational factor largely varies with the size of the factory and the nature of the production. Labor is available throughout the Province in sufficient quantities to satisfy the requirements of small factories. On the other hand large factories take some time to reach full production and when necessary sufficient labor can usually be attracted by building houses near the factories.[21] Motor transport has also increased the mobility of labor and thereby tended to reduce its influence within Ulster as both a locational and siting factor. Where internal transfer costs do not materially influence production costs social considerations have played an increasing role in recent years in governing the location of some firms. Many of these have been established in areas where there were pockets of unemployment. This contributed towards the solution of a grave social and economic problem and often introduced a greater measure of stability into the local economies.

RAW MATERIALS AND MARKETS

Only to a very small extent have raw materials and markets had continued influence on the location of industries in Ulster. In most cases these factors reached their maximum importance in the critical early years of an industry's or factory's growth. The nature of the raw materials and transfer costs have, however, been important locational factors in some industries, such as food processing, clay, and stone work. Internal markets also had a limited control over a few small industries which were largely protected by the Irish Sea from British competition and by freight charges within the Province from internal competition. The location of such industries was strongly influenced by population centers and communications. Ancillary industries were also market orientated, but in this case their location was strongly influenced by the distribution of the industries they served. All the major industries relied on external markets which were widely dispersed and this, in addition to the high value/weight ratio of their products, greatly mitigated the influence of the markets on their location. What little influence they have had tended to draw these industries nearer the main ports.

WATER AND POWER

The rather limited influence of another locational factor was observed—namely, water, both as a source of power and as an agent in various industrial processes. This factor had considerable influence on the location of the textile finishing industry, but its effect on the distribution of industry in general was negligible. Water was more important in influencing the choice of a factory site than a location for an industry. In contrast to this, in the selection of a particular site in the past, water power played an important part, but recently the widespread distribution and general use of electricity has lessened its control. Rivers or other bodies of water often strongly influenced the choice of a site when effluent disposal was of

[21] If necessary the Government of Northern Ireland undertakes to do this under the provisions of the 1945 Industrial Development Act.

great importance or where a great deal of water was used in the factory itself.

COMMUNICATIONS AND CAPITAL

Communications have also been of minor importance as a general factor controlling location and their influence has been greater on siting. Little information could be obtained to assess the control of capital on location. It is tentatively thought that its importance has steadily declined.

The distribution of wealthy people had a limited influence on industrial activity in the early part of the period studied, but the growth of banking and a consequent greater mobility of capital soon curtailed its influence within the Province. There is reason to think, however, that the greater ease with which capital can be obtained in Britain may adversely affect Ulster as a location for industry. Possibly capital at present has greater control on the growth of industry and factories than on their location.

BELFAST

One of the most significant features of the changing distribution patterns of industry studied, has been the gradual concentration of manufacturing in Belfast. In 1951 approximately 78 per cent of all those engaged in manufacturing industry were employed in factories situated within 20 miles of this city. But Belfast factories alone employed approximately 58 of the total 78 per cent. The geographical position of this area and of Belfast in particular was an important factor which helped to bring about this concentration of industry, and the industrial structure served to increase the influence of geography as the major industries have been dependent on imports of raw materials and the export of the greater part of their production. The ports of Belfast and to a lesser degree Larne have consequently had a growing pull on the location of industry, and as the industries grew so did their dependence on port facilities. The position of Belfast at the head of the Lagan valley, leading into the heart of the Province, and the numerous passes from the city opening the regions to the north and south further increased the attraction of the city. Belfast quickly became the focus of a growing Provincial communications system which in turn greatly influenced the location of industries primarily dependent on the Ulster market.

HUMAN ASPECTS

It must not be forgotten, however, that the exploitation of the natural advantages of this region was largely due to the character of the people living there. Long before the growth of modern manufacturing industry, there had been much contact with the more industrial areas of Britain and a large proportion of the population was descended from British immigrants. On the whole, people in this region were more progressive than those in other parts of the Province. It is impossible to assess accurately the influence of this human factor, but it is felt that it was most important in governing the growth and speed of industrial development as well as the location of industry. By quickly adopting new production methods, entrepreneurs in the Belfast area were often in a far better competitive position than their less progressive counterparts in some other parts of the Province. In the linen industry, this eventually led to major changes in the location of the industry without any significant movement of entrepreneurs to the Belfast

area from the districts where the industry had declined in importance.[22]

Population distribution was also an important factor which influenced the concentration of industry in the Belfast area. In addition to the emigration of a large number of people in the period studied there was a relative movement of population within the Province. Most of the rural districts lost part of their population, but the majority of the market towns increased in size. Compared with the rest of Ulster the region within 20 miles of Belfast increased its importance as a center of population and in 1951 it contained slightly more than 50 per cent of the total population of the Province. The growth of industry in this region was both a cause and effect of population changes, but it is felt that often it was not the primary cause. Nevertheless, the relative concentration of population was a most important factor influencing the location of new enterprises. This is a factor which must be considered when discussing the policy of dispersing industry more evenly throughout the Province.

EVALUATION OF SOME OTHER APPROACHES

As explained earlier, Josiah Stamp considered the physical factor to be the dominant control on economic activity whereas Buchanan believed "the geography of production" could be explained in terms of geographical and economic factors. Fisher, on the other hand, states that "political ideas and distributions lie at the heart of the matter." In this study, however, it was shown that throughout the period studied not only did the causal factors vary in their nature and importance, but also in their effect on each industry. Therefore, if the factors suggested by Stamp, Buchanan, and Fisher are not always dominant in their influence on each industry then they cannot be the factors which always govern the pattern resulting from the economic activity of society as a whole. The approaches suggested by Stamp, Buchanan, and Fisher are not suitable for the study of all economic activity and in particular for the analysis of causal factors which have influenced the pattern of manufacturing industry in Northern Ireland. This study further emphasized the need to begin research without preconceived ideas about the importance of various causal factors, to avoid a biased or deterministic approach.

It was also found that by considering the effect of causal factors on the size, structure, and distribution of manufacturing industry a fuller understanding was achieved of how changes were brought about in the industrial pattern. This served to distinguish the nature and effect of the factors, because they varied in their influence on the size, structure, and distribution of the pattern. For example, it was shown that at any particular point in time certain factors governed the growth and structure of particular industries, yet they had little, if any, influence on the actual distribution of the industries in the Province.

CONCLUSIONS

In general, however, the growth of manufacturing industry in Northern Ireland has been largely influenced by economic and political factors over which Ulster manufacturers have had little control. The industrial structure, on

[22] For example, hand-loom factories in the Ballymena area (27 miles from Belfast) declined between 1875 and 1900 primarily because they could not compete with power-loom factories concentrated in the Belfast area. This led to an important change in the location of weaving. The Belfast area increased in importance without attracting Ballymena entrepreneurs who were forced out of their hand-loom factories.

the other hand, has been greatly governed by the nature of demand for manufactured goods and Ulster's poverty in raw resources. In addition, the relative abundance of labor has also favored the development of industries requiring a considerable amount of skilled and semi-skilled labor, while the dependence on export markets greatly governed the development of industries in which transfer costs formed a small part of total costs. The distribution of manufacturing industry has, however, been largely influenced by the distribution of skilled and semi-skilled labor and that of population in general.

Changing world conditions are focusing attention on the weaknesses of the present industrial structure which is largely the product of another era. There is too great a concentration on a few large industries which are vulnerable to the influence of trade cycles and some of these are also declining. In addition, the great dependence of the major industries on imports of raw materials and on export markets renders them still more vulnerable. But Northern Ireland's industry must export if it is to maintain its present size. The growing importance of the British market has, therefore, introduced a greater measure of stability. Greater stability in present-day conditions is also being achieved by the slow progress made in diversifying the industrial structure and industries are being developed for whose products there is a growing demand. The location of new industries is still greatly influenced by the concentration of suitable labor, population and industry in the Belfast area.

The future growth and structure of manufacturing industry in Northern Ireland will largely depend on human reactions to changing conditions. In turn the distribution of industry will be greatly influenced by changes in the size and structure of manufacturing industry and the respective strength of and the interrelation between social and economic considerations on the choice of location.

BOOK REVIEWS

Migration and Economic Growth, A Study of Great Britain and the Atlantic Economy, by BRINLEY THOMAS. xxv and 362 pages; tables, diagrams, appendices, subject index. Cambridge University Press, 1954. $8.00. 9¼ x 6¼ inches.

This study belongs to that growing body of literature by economists which is of value to geographers, especially those interested in regional development and the relationships between regions. The central inquiry is a careful statistical analysis of trans-Atlantic migration and its relationship to economic growth, especially prior to 1913, which forms the basis for conclusions at some variance with previously held views regarding these relationships. For the geographer, however, the value of the study derives mainly from the author's basic premise that, during the 19th century, the "Atlantic community of nations . . . [was] one economy made up of interdependent regions . . . [in which] the expansion of the whole entailed a certain rhythm in the parts. Growth required the transfer of labor and capital from west to east [internal migration from the point of view of the economy]." Neither the "Atlantic economy" nor its component "regions" is precisely delimited. However, this "regionalization" on the basis of national units allows the use of national statistics and international trade and migration data to illuminate aspects of "regional" development and interrelationships. Thus the resulting conclusions are germane to contemporary growth relationships between areas.

In the main body of the book Thomas analyzes in detail the flow of emigrants from Europe to the new world (especially North America) during the period 1830–1913, examines its determinants, and, in particular, attempts "to unravel the interaction between the pace of developments on either side of the Atlantic." Basic to this inquiry is the analysis of the minor secular fluctuations in the trends with which the author deals. Most simply and briefly stated, the statistical method (inspired by the work of Kuznets in his *Secular Movements in Production and Prices*) is, first, to fit a computed secular curve to a series of data (annual emigration from the U.K. to the U.S., for example), then the original data are expressed as percentages of their corresponding ordinates of the secular curve, and, finally, a nine-year moving average is calculated for these variations. The swings in this last curve of variations around the trend are of longer duration than those of the shorter term "business cycles" and are therefore called "minor secular fluctuations" or "long cycles."

Examining the immigration into the United States from Great Britain, Ireland, Germany, and Scandinavia, the author finds a similarity in their long cycles in which the "time span from trough to trough and from peak to peak is roughly simultaneous and of the same length for the four series." This coincidence meant that emigration from Europe was characterized by four "expulsions" of population with peaks in the periods 1844–1854, 1863–1873, 1878–1888 and 1898–1907. Thomas concludes that the most important determinants of these waves and their timing lie in the "push" of European conditions: a) the births cycles in the various European countries which produced greater than average numbers of persons in the 20–35 age group at times when, b) natural and socio-economic influences created conditions of crises for the agricultural populations. "The 'Malthusian Devil' crossed the European continent from Ireland to Germany, then to Scandinavia and finally to Southern and Eastern Europe, where his sway was greatest of all."

Next, the relationships between these long cycles of migration and those of economic growth are carefully examined. In the United States, especially prior to the 1870's, Thomas finds that the long cycles of immigration generally *preceded* by 1 to 3 years the minor secular fluctuations in various investment and growth trends such as railway construction, building activity, freight car loadings, and pig iron production. This leads the author to qualify the traditional view that the "pull" of economic opportunity in the new world was the dominant force influencing migration flows. Instead, he concludes, the manpower "expelled from Europe . . . made for itself a niche in the American system where it exercised a direct formative influence on technical conditions of production and habits of consumption, and thereby set in motion a 'pull' for further immigrants."

Turning to the other side of the Atlantic, Thomas finds the periods of upsurging migration from Great Britain coincided with increasing foreign investment and export of capital goods. In contrast, the downswings of the emigration long cycles were characterized by upswings in domestic investment, building activity, internal population movement, and rising wage income within Great Britain.

On this basis there emerges a thesis of the "regional" interaction within the Atlantic economy. "When the United States experienced a strong upsurge of activity, she absorbed large quantities of labor and capital from Britain and

the rate of growth in the latter country slackened. Then, when the American system was digesting what it had swallowed, Britain's appetite for home investment would increase and her real income would grow faster than usual, while her exports of men and money became negligible." This inverse relationships between the long cycles of economic growth on opposite sides of the Atlantic was predicated upon the transfer of men and capital from east to west—from the "developed" to the "under-developed" areas. It also required a return flow of goods from the new to the old world. Given the nineteenth century's relative freedom of international trade and migration, both "regions" could grow and expand without running into an economic deadlock.

In his final chapters, the author turns to the fundamental changes in these relationships which began at least in the 1890's. By the 1920's "the conditions which had made it possible for the century-old mechanism of international adjustments to work successfully had passed away, and the fundamental disequilibrium has been aggravated by the economic consequences of the Second World War." The United States replaces Britain as the leading industrial and capital-surplus "region"—and occupies a much more commanding position. Also, in contrast to nineteenth-century Britain, the United States is a relatively under-populated, much more nearly self-sufficient, tariff-protected nation, whose imports are relatively less in proportion to gross national product and hence potentially more variable. Finally, barriers against immigration (especially the American Quota Act) have made a profound difference in the working of the international economy. Adjustments are no longer automatic under these changed conditions, but might be achieved, Thomas feels, by careful operation of international monetary funds, and some modification of tariff and immigration restrictions.

In his last chapter, "The Atlantic Economy: Old and New," the author suggests an interesting analogy. The closest parallel to the old Atlantic economy is now to be found within the United States, with its internal freedom of movement for people, goods, and funds. This comparison is not examined in detail but it is clear that most of Thomas's conclusions are applicable to the relationships between *intra*-national regions. His methodology might also be applied—within the limits of available data—to a consideration of the relationships between northeastern industrial states and other sections of the country. The study, therefore, is of value not only for its examination of historic relationships which have contemporary application, but also in pointing the way to further lines of inquiry, largely within the province of the economist, but also impinging on that of the geographer.

THOMAS R. SMITH

University of Kansas

The Future of Underdeveloped Countries: Political Implications of Economic Development, by EUGENE STALEY. xiv and 410 pp., 1 map, notes, index. Published for the Council on Foreign Relations by Harper & Brothers, New York, 1954. $5.00. $8\frac{3}{4}$ x 6 inches.

This is an important book and it seems desirable that all geographers interested in economic and political matters read it thoughtfully. The author had the opportunity of submitting the ideas presented in this volume to the critical discussion of a special study group of the Council on Foreign Relations. Each part of the work has thus been carefully weighed. The book is more than one man's work and will probably serve as a helpful source of inspiration to many people concerned with the elaboration of policies in America and abroad. For this reason alone it would deserve a great deal of attention, and to the scholarly study of some of the major problems of our time it brings much more.

Dr. Staley has divided his treatment of the problem announced in the title into three parts. Part I endeavors to clarify the objectives of economic development as we understand them in the western democratic world. Part II deals with the objectives of economic development as they appear in the Communist world movement; and the author rightly remarks that "the Communists are pressing upon the underdeveloped areas, with great energy and skill, a formula for development which, if accepted, would defeat most of the aims we take as fundamental" (p. 9). The present world is divided, as Dr. Staley demonstrates, into two main concepts of development which are in sharp conflict. To one side, development is "successful" when it brings the area to be developed closer to serve the final Communist goal of world domination. To the other, the democratic side, development to be "successful" must mean: widely shared higher levels of production and real income; progress in democratic self-government; growth of democratic social relations; and growth of attitudes that make for a more peaceful world, for freedom both from external aggression and from use of power to oppress others, etc. (see pages 94–95). Dr. Staley remarks that "successful development is a multi-valued goal. That is, achievement cannot be adequately measured in terms of any single economic, social, or political accomplishment or in terms of the advancement of any single human value" (p. 95).

Part III, the most important of the volume, "explores the key factors which will affect the prospects for attaining not only more production and better material conditions of life but also the broader political and social objectives included" in the democratic definition of successful development. This is a cautiously worded statement of intention and such it should be, for the matter is not simple and oversimplifica-

tion there may well lead to confusion and disaster. In this last part, some chapters review the well-known points, so frequently raised in connection with backward areas of agrarian reform, capital formation, population growth, raw materials, and industrialization. But Dr. Staley pays constant and overwhelming attention to the human resources and the organizing factors, to political and social requisites, to a world environment which is not the geographer's usual one, made up of natural and material-elements, but one full of subtle connections within a country and with the outside.

The question arises, and carries many consequences for the common understanding of the geographical method: have all these subtleties to be taken into account for the practical survey of a given area, especially of a backward one? Whoever has read this book will, in our opinion, be convinced that the answer is in the affirmative. Throughout this volume Dr. Staley emphasizes the political implications of economic development. He shows that development is largely a "state of mind" and that it is also "means" rather than "aim." One of the key sentences of the volume says: "The will to develop is in essence a matter of what individuals and social groups want, and whether they want it badly enough to be willing to change their old ways of doing things and to work hard at installing the new" (p. 218). In his elaboration of this crucial point the author shows perhaps more optimism than this reviewer would allow; resistance to change has been one of the great forces shaping history in the past and geography as well as politics in the present. To overcome it may prove beyond the effect of even the cumulative factors listed in this volume. But the more advanced countries would certainly be unforgivable if they did not try their best to bring about the changes they believe in.

On the whole this is a most thoughtful book, full of wisdom and of cautious courage. It goes as far in outlining the general principles that should underline the action of Western Powers in underdeveloped areas, as one may go. Dealing with problems with so many factors involved and so many facets, and entanglements, it must be brief and dense throughout. Footnotes and a bibliography in each section refer the interested reader to more detailed sources.

The geographer, however, cannot help reflecting on the final significance of such generalized conclusions as to the behavior of underdeveloped countries and of development processes. The usefulness of such generalizations is considerable and undisputable; for policy-making it is indispensable. But for applying such "guidelines" as set forth in Dr. Staley's conclusion in the field, the responsible executives are each time faced with a specific problem somewhat different from the general picture. In every one of the two to three hundred cases involved in the practice of underdeveloped areas, the various factors and processes to be considered combine in a particular way; there are local conditions providing all elements involved with a common mooring which bears the name of the area or of the people conisdered. These local conditions are of course much more than is recited in the classical description provided in geographical textbooks. They must be made to mean also local social structure, the educational system, the beliefs of the people, the memories of the past, the popular slogans of the day, the whole understanding this people has of its territory and of its relations with the world at large; but this is all rooted in a given geographical location and must influence the ways and means of the application of policy. Variety is the great rule of our world; unless we respect it, no large scale endeavor, however generous, can succeed in the long run. It may well be that it is in this field, which is not alien to the objectives of a study like Dr. Staley's, that geographers could make their main contribution.

This volume of Dr. Staley's belongs in a category of studies that are definitely easier to criticize than to make. Strangely enough it is hard to find much criticism in this case, in so masterly a fashion has the author covered his difficult assignment. Although he wrote for American readers, it would be highly desirable to see his volume widely read abroad, even translated into various languages for those less familiar with American works and thinking on the matter. For it is indeed a substantial contribution to better international understanding.

JEAN GOTTMANN

University of Paris

Transformation: The Story of Modern Puerto Rico, by EARL PARKER HANSON; with an introduction by Chester Bowles. xxiii and 416 pp.; maps, index. Simon and Schuster, New York, 1955. $5.00. 8½ x 6 inches.

This is the story of a man, a people, and a unique experiment in the development of a depressed area. The man is Governor Luis Muñoz Marín, Puerto Rico's master statesman and politician; the people are more than two million Puerto Ricans; the experiment is "Operation Bootstrap," the organized campaign in Puerto Rico's struggle to achieve political, economic, and social progress.

Professor Hanson is an old hand not only in Puerto Rican affairs but also in the general theme of underdeveloped areas. "Transformation" is his latest in a series of works touching upon this theme. Others include "The Amazon: A New Frontier?" and the highly provocative "New Worlds Emerging." Hanson's interest in Puerto Rico began when he made the acquaintance of a struggling Puerto Rican poet

and patriot, Muñoz Marín, and learned of the island's plight in the congenial atmosphere of Long Island soireés and sundry New York bistros. His interests became more than academic when, in the depression-wracked thirties, he sought employment in the Puerto Rican Reconstruction Administration. Since then Hanson has viewed the growth in stature of his friend, Muñoz, and the progress of Puerto Rico like a proud and delighted godfather who was there at the baptism. And herein lies one of the few weaknesses of the book.

Hanson's sincere enthusiasm for the Puerto Rican drama and its principal actors, on occasion, lead him to skirt dangerously close to subjectivity. He is too prone to rationalize every stand of "Muñocistas" while lightly refuting the criticism of the opposition. Muñoz himself emerges from the pages of the book as an almost legendary figure, and the small dedicated group of administrators around him tend to resemble crusaders doing battle with the evil forces of colonialism, clericalism, and the sugar interests for the sake of their beloved "jibaro" (peasant). This, however, detracts little from the author's basic message.

In addition to the introduction by Chester Bowles, "Transformation" contains 22 chapters, each chapter a well-turned essay dealing with some facet of the changing insular microcosm in the last 25 years. The first 11 chapters outline the Puerto Rican tragedy prior to the advent of Muñoz by playing upon the discouraging realities of politics, economics, and education in Puerto Rico's old colonial setting. It is in this first half of the volume that Hanson is at his best. Relying upon a lively, quasi-journalistic style well laced with amusing anecdotes and the intimacy of personal experience, he is effectively convincing. The second half of the volume deals with the transformation which has taken place on the island since Muñoz came into power in 1940. Hanson skillfully delineates the considerable progress made, particularly in socio-economic endeavor, and he suggests that the method of transformation sprang largely from the gradual elimination of "colonialism" and from granting to Puerto Ricans, for the first time in their long colonial history, a major share in shaping their own destiny.

In assessing these progressive changes the author is forced to rely heavily upon statistics, the reports of government agencies, and the speeches of political leaders. The touch of personal experience so apparent in the first half of the volume is gone. This, coupled with Hanson's enthusiasm for Puerto Rico, lead him to commit a minor sin of exaggeration both as to the degree and significance of the transformation and the importance of the role played by Muñoz. For example, while it is true that Public Law 600 has given the island considerable local autonomy, it is equally true that this autonomy is fictitious as long as the United States Congress has the final word in insular government. The impressive industrial statistics showing that 325 new factories have begun operation on the island also show that the total employment in these new factories is only about 20,000; that, with some exceptions, the new industries are labor oriented fly-by-nights from the sweat shop circuit of New York, which were attracted to Puerto Rico largely by low wages and tax exemption. So, too, with the degree of credit given to Muñoz for the progress. Few will deny his achievements in land reform, educational and health improvements, political progress, effective economic planning, and the creation of an air of optimism regarding the future. To attribute the transformation of Puerto Rico largely to the genius and dedication of Muñoz, however, is to deny the considerable influence, among others, of the financial windfalls resulting from wartime federal spending, G.I. benefits, the unprecedented sale of rum during the war years, and other unexpected sources of income. It further glosses over the fact that the years of transformation (1940–1955) have been a period of extraordinary prosperity for the United States of which Puerto Rico is an integral economic segment. In addition, to suggest, as Hanson does, that the Puerto Rican experience can be repeated in other poorly endowed areas by the elimination of political and economic colonialism is to carry a theory to extremes. Such a suggestion minimizes the unique advantages of Puerto Rico's access and relation to the world's richest market, the largest source of investment capital, and what is probably the most generous government in the treatment of dependent peoples.

Finally, from the viewpoint of the orthodox geographer, the book contains a few flaws of presentation and emphasis, but it also contains some challenging suggestions in the orientation of geographic research. Hanson's pitiful stab at cartographic representation is almost unforgivable for one who wears the badge of the geographer, and his tendency to focus upon the personality and the event often blurs the picture of the area. At the same time, however, Hanson's running attack upon the remaining myths of environmentalism especially those applied to the tropics; his insistence that it is the socio-economic and not the physical climate which is at the root of retardation; his implied suggestion that the study of human geography should begin with the institutional equipment of an area and proceed to the physical attributes (rather than vice versa)—present a challenge which geographers concerned with the nature of depressed areas can ill afford to ignore. "Transformation" is a contribution both as an example of the verve badly needed in geographic writing and the equally needed more dynamic

approach to the valuation of colonial areas. The profession would do well to investigate it.

JOHN P. AUGELLI

University of Maryland

Symposium on the Geography of Puerto Rico. Edited by CLARENCE F. JONES and RAFAEL PICÓ. xxviii and 503 pp.; maps, including folded maps in map pocket, diagrs., ills., index. University of Puerto Rico Press, Río Pedras, P.R., 1955. $4.50. 9 x 6 inches.

A few years ago, at a conference devoted to discussion of geographic research projects, I raised the objection that too many such projects were largely exercises in geographic techniques, too distantly related, if at all, to human problems and realities. I pointed out, however, that the Puerto Rico land-use survey, carried out under the guidance of Dr. Clarence Jones, was an outstanding exception. Requested by the government of Puerto Rico, in line with Governor Muñoz Marín's dictum that government must act according to the promptings of a conscience *which is well informed*, the survey was an integral part of the almighty "Operation Bootstrap" by which Puerto Rico is today making world history through its developmental programs to raise standards of living. The final chapter of the symposium here reviewed tells an impressive story of the manners in which the survey results have already proved valuable to a number of Puerto Rican agencies such as the Department of Agriculture and Commerce and the Planning Board, and of the new research projects which have already developed from the survey. Even the Puerto Rican legislature is aware of the survey's practical value; a few years ago an important piece of legislation affecting one section of the island was held up until the legislators had assured themselves that the land-use surveys of that section had been completed and the results were available for legislative as well as executive guidance.

Drs. Jones and Picó, who, in arranging for the survey, carried out a suggestion made earlier by Raymond Crist, have done a service to American geography, not only through the development of effective techniques but also through the example of a scientific research project geared directly, at all conceivable points, to human needs and problems. In the preface one reads that "The scope and extent of the field work involved in the Rural Land Classification Program of Puerto Rico have not been matched elsewhere in the tropics."

Carried out primarily by advanced non-Puerto Rican students of geography, the survey was also a valuable educational venture, which has by now resulted in nearly 20 doctoral dissertations for nine American universities. The present symposium is based largely on those dissertations.

As shown by this book, the surveys and individual studies went far beyond land use. The topographic analyses and climatic data are a contribution to Puerto Rico's physical geography; in most cases, studies of farming methods, etc., are geared to existing realities of transportation and marketing; various historical accounts, as of land use in general since 1500, of coffee production, of plant introductions, give substance to expositions on present-day conditions; the recommendations for improvement made by various observers, are made with a good background-knowledge of Puerto Rico's overall social-economic climate.

Chapter I, by Donald R. Dyer, deals with the survey techniques used. It is followed by a chapter on the geographic classification of landforms, by Robert N. Young. Chapter III, by Wallace E. Akin, presents an analysis of the dairy industry of the San Juan area. Bernt Lloyd Wills contributes a chapter on the limestone belt of north central Puerto Rico, where the principal crops are sugar cane and pineapples. William W. Burchfiel's chapter on the pineapple industry is a good analysis, ending with pertinent recommendations for improvement. Robert B. Batchelder's chapter deals with land use problems in the region of Isabela, and with such crops as sea island cotton, tobacco, coconuts, and market vegetables. Harold R. Imus discusses the sugar cane economy of the Mayagüez area, and reaches into various social and economic problems encountered. Chapter VIII, by Arthur H. Doerr, deals with environment and economic activities in southwestern Puerto Rico. The cattle farms of southern Puerto Rico are discussed by Donald D. MacPhail, and land use in another part of the south by David F. Naley. George Beishlag contributes an impressive chapter on trends in land use in southeastern Puerto Rico. The Caguas–San Lorenzo Region, its land types and utilization, is discussed by Vernon C. Brockmann; and John P. Augelli contributes an excellent chapter on rural settlement types in the interior. The subject of types and patterns of rural settlements is carried farther by John F. Lounsbury. Chapter XV, by Luther H. Gulick, Jr., presents an occupance summary of rural Utuado and Jayuya, in the tobacco region. Dieter Brunnschweiler discusses problems of land use in Ciales, Morovis, and Orocovis. The coffee industry of the western highlands is well discussed, with a number of pertinent recommendations, by Harold R. Imus. David Gómez Montoya and Héctor H. Berrios prepared the final chapter on the uses made of the data obtained in the rural land classification program.

The book is well edited, attractively designed, and its many maps are clear. Its importance goes far beyond Puerto Rico itself. It will

become known as a model for land-use analyses everywhere.

EARL PARKER HANSON

University of Delaware

Le Sahara Français, by ROBERT CAPOT-REY. Tome Second de L'Afrique Blanche Française, Géographie de L'Union Française. viii and 564 pp.; maps, diagrs., tables, ills., appendices, bibliogr., index. Presses Universitaires de France, Paris, 1953. 2000 fr. 9 x 5½ inches.

Le Sahara Français is probably the best geography on the desert to appear in recent years. The organization, style of writing, critical notes and hundreds of bibliographical references, balance between physical and cultural elements, and studied conclusions on a wide range of topics mark the work of an expert. The author is desert geographer at the University of Algiers.

Like most books that attempt to cover a vast area, *Le Sahara Français* has its minor errors, omissions, and thin spots. The small print and rough paper used for the series keep publishing costs down but do not make attractive volumes. Additional maps would have made some points much clearer. However, errors and omissions are difficult to find, while one cannot help being impressed with the author's grasp of the material and his accuracy and skill in presenting it. The book covers the desert portions of French Morocco, Algeria, Tunisia, French West Africa, French Equatorial Africa, and the Fezzan, which was conquered by France from Italy and administered until Libya became an independent nation.

The first section, consisting of five chapters, summarizes the physical features of the Sahara. Both the present nature and the past changes of climate are considered. Much recent information is included, such as the seasons of rainfall for different regions and the variations in precipitation from year to year and from place to place. The author supports the view that there have been no general changes in climate during recent times, and explains the factors (erosion, drifting sand, overgrazing, changes in drainage, etc.) that often give the impression of progressive desiccation. Much of the material on landforms and climate is a summary of earlier work by Gautier and others, but Capot-Rey's contributions on arid land morphology, sand dunes, indices of aridity, and hydrology are included. There are several detailed black and white maps on geology and climate. Mention is made of the climatic contributions of Köppen, Thornthwaite, and others. The desert limits adopted by the author, taking account of aridity, vegetation, and commercial production, lie near the isohyets of 100 mm. (4 in.) on the north and 150 mm. (6 in.) on the south. The great interior has an average annual precipitation of less than one inch..

In a longer second section, also consisting of five chapters, the author considers the human geography of the Sahara. Population distribution, ways of life, pastoral migrations, and oasis agriculture are dealt with in a competent and thorough manner. Capot-Rey's chapters on pastoral migrations and oasis life show the results of long and careful research. The areal differences in human geography are described and explained, and in Chapter 10, "Les Divisions Regionales," the physical and cultural elements are combined in a regional outline that contributes to both knowledge of the Sahara and methods of regional analysis. The author points out that the "blinding unity" of arid climate, sparse vegetation, and meager resources often results in a failure to note the distinctive characteristics of the various regions. Capot-Rey outlines the Northern, Southern, Central, and Atlantic regions of the Sahara west of central Libya, but makes only a few tentative suggestions on further division. The bases for the grand divisions are climate, vegetation, pastoral life, types of irrigation, variations in products, peoples, and the number and relative prosperity of the oases. One gains the impression that this is art rather than science, and that (with sufficient time and money) statistics, field techniques, and detailed mapping would give better results.

On types of wells and methods of irrigation, Capot-Rey improves upon the work of Augustin Bernard and others, showing regional differences by means of a map and written description. The same applies to modern caravan routes and motor trails. On a number of subjects, however, there is still much to be done before the picture of the Sahara is complete. The historical geography is hard to reconstruct, as in other parts of Africa, because of the lack of written records, and to date only a start has been made. The picture of caravan trade, even for the present, is far from complete. Studies of house types, handicrafts, oasis life, and nomadic tribes are still unavailable or incomplete for many areas. At the end of each chapter and section the author summarizes what has been accomplished and what remains to be done.

The third and last section of the volume has two chapters dealing with the work of the French in the Sahara, and the problems of development. Professor Capot-Rey believes that the local administrators in the Sahara have been able, and conscientious, in considering the welfare of the indigenous peoples, but that the difficulties have been great and the funds insufficient. During the 1940's, for example, a series of dry years and cold winters was a major catastrophe for the nomads of the northern steppes, and the number of sheep declined sharply in several

areas. In the Geryville district, where for several decades 30,000 inhabitants had possessed 250,000 sheep, the bad years combined with increasing population and migration to result in a population (1946) of 80,000 with only 100,000 sheep. Since then the number of sheep has increased, but still does not equal the old figure. The population of the French Sahara doubled between 1906 and 1946, outstripping economic production in many areas. However, there are some districts where the standards of living have been maintained or even improved. The French deserve credit for the drilling of wells, construction of roads, improvement of date cultivation and marketing, etc. The author is modest in regard to past accomplishments and concerned over the miserable living conditions of many oasis peoples.

The author is also aware of the social problems that accompany the changes made by technical advances, and analyzes several of them. The suppression of raiding and the slave trade deprived certain tribes of customary sources of income and forced them to adopt new customs. The introduction of manufactured goods disturbed the traditional handicrafts of the oases. Changes in transportation and marketing conditions sometimes caused a breakdown in the social organization of nomadic tribes. As in other parts of Africa, the commendable programs of law enforcement, improved sanitation, and medical assistance, and the prevention of famine and warfare have resulted in an overall increase in population that tends to depress the standard of living, cause migrations, and destroy the traditional society.

Aridity is, of course, an almost overpowering handicap in the Sahara, but to assume that climate is the direct cause of the numerous problems is to oversimplify matters. In the concluding chapter, Professor Capot-Rey outlines the major reasons for the decline in oasis agriculture and in population which characterizes certain parts of the Sahara. This decline can often be traced back to the abolition of slavery and the partial substitution of motor transport for camel caravans, both of which helped to free the oasis laborers from a fixed residence and the requirement of steady labor in drawing water, cultivating fields, etc. Other effects followed, such as the competition of cheaper imported grain with local oasis cereals and the drift of oasis workers to the cities of Barbary. To correct the problems of low agricultural production, insufficient power, and skilled labor, and a low level of education and living standards, Professor Capot-Rey suggests numerous reforms. As examples, coal from the Kenadsa district, water power from certain mountains and plateaus, and windmills on the plains could provide energy for pumping water. The nomads might be assisted through the continued introduction and improvement of plants for pasturages, cooperative marketing, and the drilling of additional wells. The viewpoint is that the problems are varied and difficult, but not impossible of solution. A plan that works for one group of oases may have to be altered or completely changed to fit the human and physical conditions of others. Specific examples are given, and there is much food for thought.

For those who have felt the need for a detailed, larger, and more recent volume as a companion to E. F. Gautier's classic but brief *Le Sahara* (English translation, *Sahara, the Great Desert*, by Dorothy Ford Mayhew) Robert Capot-Rey has provided the answer.

BENJAMIN E. THOMAS

University of California, Los Angeles

Jordbrukets Geografi i Norge (Geography of Norwegian Agriculture) A. Tekstbind, by AXEL SØMME. First edit. 415 pp.; maps, diagrs., ills., English summary, bibliogr., index. No. 3A, Publications of the Norwegian School of Economics and Business Administration, Geographical Series. J. W. Eides Forlag, Bergen, 1954. Norwegian Kr. 60.00. 8 x 11 inches.

The first modern, comprehensive information on agricultural geography in Norway became available in 1949 when Axel Sømme, professor of geography at the University of Bergen, published his atlas volume of *Jordbrukets Geografi i Norge* as Part B. of a two-volume work. In the fall of 1954, Part A, the accompanying text, came from the press. It is one of the most detailed analyses of the agricultural geography of a nation that has appeared. It is simple in explanation of individual phenomena yet complex in the interwoven dependency of one factor upon another. Because it assumes a basic knowledge of Norway and an understanding of agriculture, it is not a beginner's text nor an easy-reading course for the overnight expert.

The main portion of the text volume, in the Norwegian language, with more than a hundred maps and diagrams and nearly as many tables, covers some 350 pages. The few photographs are superb. Less than 50 pages are devoted to climate, bedrock, and soils in the two opening chapters. Beginning with consideration of plant needs, about which so little is actually certain, the author considers individual effects of various climatic factors. Equivalent temperature averages do not mean similar conditions from place to place.

The length of the frost-free period in summer and the total degree days of heat during that period depict the climate of a station, but alone they are not good criteria for evaluating growth conditions. The author discusses the use of the 10° C. daily mean temperature in spring

and fall as outside limits of the growing season in inland and upland locations. In certain other localities outside limits of 6° C. daily mean temperature are better suited to provide a true picture of actual vegetative growth. In high latitudes or altitudes high daytime temperature (as recorded at 2 p.m. in Norway) is generally more effective for crop growth than lower daily mean temperature where there is little variation, a condition common to northerly coastal locations. In some places the daytime high temperatures become too high for the crops concerned, which then suffer ill effects.

Rainfall amounts and distribution, snow cover, frost depth, and atmospheric humidity vary in influence with location, plant variety, soil, slope, orientation, duration of sunshine, and temperature differences. Each has its effect on agricultural productivity. Individual places and crops are cited for illustration. Few broad conclusions are drawn.

The climate and northerly location of Norway are less critical in their effects on agriculture than are scarcity of soil cover and quality of arable land. Less than 3 per cent of the national area was under cultivation in 1939. Variations in soil development depend on bedrock origin, glacial action, mode of soil accumulation, and terrain. Podsolic soil development is most common. Brown earths are found in certain restricted western locations, but more abundantly in the southeast. Arable land is largely glacial moraine, marine sediments, and stream deposits. In certain localities, where the Cambro-Silurian sedimentary bedrock is weak, there are minor amounts of shallow residual soil. Where drainage is feasible, bogland has become an important agricultural soil. Drainage problems are difficult. Much of the bogland yields poor soil, but modern technical means have created great interest in its addition to arable area. Forestry and agricultural interests conflict in its reclamation, as they generally do in attempts to increase the amount of land under cultivation. Soil types are reflected in farm organization and crop emphasis.

A chapter on Norwegian agriculture in 1939 is directly related to the Atlas, which was based on census figures for that year. Another chapter is devoted to conditions and changes in Norwegian agriculture during the first half of this century.

Nearly half of the Norwegian text is regional discussion, wherein socio-economic relationships are important. Competition between agriculture and forestry for area and labor supply is well illustrated by specific examples. Use of many tables and maps is highly effective, especially in demonstrating minute parcelling of arable land, differences in farm organization, areal utilization, and crop emphasis. Each of these is referred to historic and social geography from region to region, and to present market and industrial conditions. Personal acquaintance with the country is almost necessary for comprehension of the author's intimate regional observations.

Modernization and mechanization of Norwegian farming have both advantages and disadvantages which are related especially to the physical conditions of the land. While production has been greatly increased and farming population decreased in recent years, there are many farms and localities where improvements have held to a minimum. In his discussion of these, the author creates word pictures of individual places, and makes brief comparisons of local situations, but determinedly abstains from predictions. His ability to consider pertinent facts without carrying any one factor as a theme is well suited to give the reader abundant information without generalization.

Following the regional discussion are several chapters on problems, recent developments, and social conditions. Foremost among the national problems is that of increasing productivity and self-sufficiency. Improvement of living standards is considered in relation to production of important dietary foods, to imports, and to necessary means of providing food in any future emergency. With respect to self-sufficiency, there is again regional discussion. Of the more populous areas in the south, the Oslo region, for instance, is more readily supplied with food than Bergen, which is much smaller. At times of poor harvest in the west, it is necessary for Bergen to get its potato supply from as far away as the eastern interior or the Trondheim region. These are normally exporters of certain foodstuffs to the rest of the country. Trondheim has an internal market reaching from Bergen to the far north, and supplies from the interior lowland are sold everywhere. Individual foodstuffs and production from farms of various size classes, transport, and self-sufficiency are considered briefly in their interdependence. Possible increases in agricultural production through improved or increased use of upland regions, and by the development of new farm land are important topics for consideration, but as a national problem they have no easy solution. The fact that, with free import, Norway could import most of its agricultural necessities more economically than they can be produced at home, creates a situation wherein price controls and subsidies, rural and urban income, bi-occupations, and national goals are all involved.

The excellent English summary of nearly 40 pages covers the text chapter by chapter, but lacks its intimate descriptive quality. All illustrations have both English and Norwegian subtitles. Bibliography and index are in Norwegian only. Twenty years of field work and ten years of compilation and writing are well reflected in the quality of this volume.

CLARA ROM LOUGEE

Worcester, Mass.

THE STAFF

Editor, RAYMOND E. MURPHY
Managing Editor, SAMUEL VAN VALKENBURG

Associate Editors

CHARLES C. COLBY
EUGENE VAN CLEEF
EARL B. SHAW
HENRY J. WARMAN
CLARENCE F. JONES
NELS A. BENGTSON
GEORGE B. CRESSEY
OTIS W. FREEMAN

Cartographer
GUY H. BURNHAM

~

CONTRIBUTING EDITORS

L. DUDLEY STAMP, London School of Economics, England

GRIFFITH TAYLOR, Seaforth, N.S.W., Australia

VERNOR C. FINCH, University of Wisconsin, Madison, Wisconsin

OLAF JONASSON, University of Gothenburg, Sweden

HANS BOESCH, University of Zurich, Switzerland

OTTO E. GUTHE, United States Department of State, Washington, D.C.

CARLETON P. BARNES, United States Department of Agriculture, Washington, D.C.

LOYAL DURAND, JR., University of Tennessee, Knoxville, Tennessee

EDWIN J. FOSCUE, Southern Methodist University, Dallas, Texas

CAROL Y. MASON, University of Tulsa, Tulsa, Oklahoma

C. LANGDON WHITE, Stanford University, Stanford University, California

CLIFFORD M. ZIERER, University of California, Los Angeles, California

THE COMMONWEALTH PRESS WORCESTER MASS.